DEPARTMENT OF DEFENSE APPROPRIATIONS FOR 1991

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE

COMMITTEE ON APPROPRIATIONS

HOUSE OF REPRESENTATIVES

ONE HUNDRED FIRST CONGRESS

SECOND SESSION

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[1] Resigned Committee, May 16, 1990.
[2] Elected to Committee, May 24, 1990.

DEPARTMENT OF DEFENSE APPROPRIATIONS FOR 1991

THURSDAY, APRIL 5, 1990.

AUTOMATIC DATA PROCESSING PROGRAMS—OVERVIEW

WITNESS

CYNTHIA KENDALL, DEPUTY COMPTROLLER, INFORMATION RESOURCES MANAGEMENT, OFFICE OF COMPTROLLER OF THE DEPARTMENT OF DEFENSE

INTRODUCTION

Mr. MURTHA. The committee will come to order.

Today the Committee will conduct an open hearing in two parts on the Department of Defense automatic data processing resources. This area involves primarily off-the-shelf commercial computers that are used for base-level operations, such as personnel, pay, logistics, and finance. Not included are computers that are embedded into weapon systems, part of command and control networks, or tactical computers for the battlefield.

The first session will address management oversight by the Office of the Secretary of Defense of those resources, for which $9.5 billion is requested in fiscal year 1991.

We welcome Ms. Cindy Kendall, Deputy Comptroller for Information Resources Management. The staff tells me that you have really done an outstanding job and that you have been extremely cooperative with the Committee. You may not remember, but last year we identified significant problems in the Department of Defense, particularly in the Army, and the staff tells me you have worked very closely with them. I note in your opening statement that you compliment the Committee for the work that we have done. I think working together we have been able to make substantial progress. We are pleased with that.

We made substantial cuts in this area, which was shocking to many people who didn't think we were looking at it. In the end most of those cuts turned out to be acceptable to the Services, and so we think both of us are on the right track. We appreciate the cooperation of you and we think very highly of your boss, Mr. O'Keefe. We don't hold it against him that he comes from the Senate.

We certainly appreciate your hard work in this field. If you will summarize your statement for us, we will put your full statement in the record.

SUMMARY STATEMENT OF MS. KENDALL

Ms. KENDALL. Thank you for your kind comments. I am pleased to be here today.

Since appearing before the Subcommittee last year, the Department of Defense has taken actions to improve its overall management practices. Last summer, Secretary Cheney submitted his Defense Management Report to the President. Using the Defense Management Report, or DMR, as its guide, the Department identified a number of initiatives to save close to $39 billion through fiscal year 1995. I will describe one of those initiatives—Corporate Information Management—which will net $2.2 billion of those $39 billion in savings.

CORPORATE INFORMATION MANAGEMENT

The Deputy Secretary of Defense, Mr. Atwood, initiated Corporate Information Management on October 4 of this past year. CIM, as we call it, is focused on improving business practices and will result in management efficiencies and increased quality, consistency and standardization of data in Department of Defense information systems. This focus will lead to the elimination of duplication in the development of multiple information systems designed to meet single functional requirements.

The Deputy Secretary established two major efforts within Corporate Information Management. First is the formation of an Executive Level Group, and second is the formation of individual functional groups.

EXECUTIVE LEVEL GROUP

The Executive Level Group will be addressing a broad management perspective for the Corporate Information Management process. This group consists of six industry representatives and three Department of Defense executives. The Executive Level Group will develop an overall approach and an action plan for Corporate Information Management.

They will also be addressing the proper oversight of automated information systems within the Department and they will review the processes and procedures of the functional groups that I will speak to in a moment.

This Executive Level Group has been constituted as a Federal Advisory Council and its results and recommendations will be provided directly to the Deputy Secretary. I anticipate that this group will meet one to two days a month during the next year to year-and-a-half.

FUNCTIONAL GROUPS

The second is the Deputy Secretary's establishment of functional groups. These functional groups represent a major change in Department of Defense information planning processes. Information systems design and development will be based on overall Department of Defensewide requirements rather than on the requirements of a single Department of Defense Component. Each of these groups, working on a full-time basis, is led by very senior functional specialists from OSD, who can assure that the business requirements are truly representative of the users' needs.

Members of each team are drawn from across Military Departments and key agencies and are comprised of key senior level policy officials, subject matter and information system experts. These functional groups will produce functional requirements for Defensewide requirements as opposed to Service-unique requirements. We have initially identified seven functional areas, and additional functional areas will be added.

Four functional groups have already been convened. They are civilian payroll, civilian personnel, distribution centers, and financial operations. Three additional groups will be convened within the next month. They are materiel management, medical and contract payment. Eventually, we plan to cover all administrative functional areas in the Department.

CONSOLIDATION OF ADP OPERATIONS

In addition to the Corporate Information Management initiative, I would like to call your attention to another Defense Management Report-related study we have underway on the Consolidation of ADP Operations and Design Centers. A fact-finding study is underway to identify potential consolidations and to assess cost savings and mission impacts. This reporting will be completed and submitted to the Deputy Secretary in May 1990.

SUMMARY

Mr. Chairman, I would like to thank you and your Committee for your support for our life cycle management policies. These policies have proven to be a valuable framework for our Corporate Information Management activities. The policies have been strengthened over the past year, and an instruction manual has been published to assist the Components in carrying them out.

I am ready for your questions, and thank you for the opportunity to speak today.

[The statement of Ms. Kendall follows:]

STATEMENT OF
DEPARTMENT OF DEFENSE
DEPUTY COMPTROLLER
INFORMATION RESOURCES MANAGEMENT
CYNTHIA KENDALL

HEARING BEFORE THE SUBCOMMITTEE
ON DEFENSE
HOUSE APPROPRIATIONS COMMITTEE

APRIL 5, 1990

STATEMENT BY THE DEPUTY COMPTROLLER INFORMATION RESOURCES MANAGEMENT

Mr. Chairman and members of the subcommittee, I appreciate this opportunity to appear before you today to discuss the management of Automated Information System (AIS) programs in the Department of Defense.

The Comptroller is the Senior Information Resources Management (IRM) Official of the Department and has policy responsibility for all general purpose information technology in the DoD. As the Deputy Comptroller for Information Resources Management, I am responsible for carrying out this policy on a day-to-day basis.

I last appeared before this subcommittee in May 1989. Since that time, the Department of Defense has taken actions to improve its overall management practices. Last summer, Secretary Cheney submitted his Defense Management Report (DMR) to the President. Using the DMR as its guide, the Department identified a number of initiatives to save close to $39 billion over the five-year period from fiscal year 1991 to fiscal year 1995. Two of these initiatives are opportunities for management improvement in automation support and automated information systems. In the next several minutes I will address these management initiatives. I will also summarize DoD's actions to respond to automatic data processing (ADP) concerns previously expressed by this committee.

Mr. Chairman, our most important and challenging management initiative is Corporate Information Management (CIM). This effort was initiated by the Deputy Secretary on October 4, 1989 and is a high-priority effort to improve information management throughout the Department. Drawn from experiences and lessons learned in both the private sector and DoD, Corporate Information Management is focused on improving the business practices which will result in management efficiencies and in increased quality, consistency and standardization of data in DoD information systems. Corporate Information Management represents a net of $2.2 billion of the $39 billion in savings from DMR initiatives.

Corporate Information Management will move the Department to a top-down, functionally-driven defense management information systems development environment which has as its premise the development and definition of new or improved business methods. Having this approach led by functional business managers at the highest levels in the Department will result in a more uniform statement of business process requirements for each functional area. This will provide the foundation which will permit the Department to move forward aggressively to improve the quality, consistency and standardization of our information systems and associated information. The essential elements of Corporate Information Management are as follows:

1. Executive-level management must establish a business policy direction to be consistently applied within each functional area across the Department;

2. Methods for each individual business activity must be challenged for significant process improvements;

3. Development of automated information systems should be viewed as a way to implement new business methods and not solely as a way to perform efficiently old methods that may be inappropriate or outmoded; and

4. Management focus should lead to common business processes and information standards. This, in turn, leads to simplified, common information systems.

The net results are more responsive business processes supported by more effective and less costly information systems.

It is interesting to note that on the day DoD began execution of the Corporate Information Management efforts, the GAO was conducting a symposium to seek advice on ways to improve the acquisition and management of information technology. The results of the symposium, published in February of this year in a report called "Meeting the Government's Technology Challenge," include several principles for making these improvements. The report stresses commitment and vision from top organizational management. It also points to the need for having access to and partnerships with the best available expertise of industry, academia, and government. It emphasizes mission support, integrated systems, and high staff qualifications. From the similarity of these principles and those used in establishing the Corporate Information Management initiative, it appears that the approach being taken by DoD is an idea whose time has come. Corporate Information Management has top level commitment and support, as indicated by the Deputy Secretary's involvement and the centralization of Corporate Information Management funding to assure its implementation. Corporate Information Management combines some of the best information technology talent and experience from industry, academia, and government in efforts to identify ways to improve our present methods of doing business and to position ourselves to handle future needs. Corporate Information Management emphasizes the need for standardized data and open systems architectures.

The Deputy Secretary established two major efforts within Corporate Information Management. First was the formation of an Executive Level Group of outside experts and senior DOD executives who were charged with defining an overall approach for Corporate Information Management. The second effort established by the Deputy Secretary was the initiation of functionally-oriented groups.

The Executive Level Group (ELG) was established by the Deputy Secretary of Defense to:

1. Recommend an overall approach and action plan to enhance the availability and standardization of information in DoD's common business areas;

2. Review the procedures of functional groups which have been established and, as needed, the products of the groups, including information requirements and data formats;

3. Review the processes and procedures for overseeing the development of new information systems and software in the DoD; and

4. Where applicable, recommend corrective actions.

The Executive Level Group was constituted as a Federal Advisory Committee and held its initial session on February 26, 1990. The Department is confident that this eminently qualified group will make a substantial contribution to our plans for Corporate Information Management. The ELG will continue to meet one to two days per month over the next twelve to eighteen months to obtain additional information and develop their report. The results and recommendations of the Executive Level Group will be provided to the Deputy Secretary.

In addition, Functional Groups are being established in common business areas to:

1. Review the information requirements of the Office of the Secretary of Defense, the Services and Defense Agencies and consider levels of compatibility and redundancy with each area; and

2. Develop uniform and consistent information requirements and data formats within each functional area.

The activities of the Functional Groups will represent a major change in DoD information planning processes. Information systems design and development will be based on overall DoD-wide requirements rather than on the requirements of a single DoD Component. Each of these groups is led by a very senior functional specialist from OSD who can assure that the business requirements are truly representative of the user needs. Members of each team are drawn from Military Departments and key Agencies and are comprised of key senior level policy, subject matter experts and information systems experts. Seven functional areas have been identified; additional functional areas will be added.

Each group will follow a structured, three-phase methodology in identifying and developing standard functional requirements and data formats. Phase one will result in the development of a functional vision for the future which is based on a statement of functional mission, policy and guiding principles. Questioning business practices and policies with a view towards increasing management efficiencies is integral to the methodology. The second phase will develop the functional requirements or business plan based on firm business goals, objectives and strategies. Lastly, in phase three, the information systems strategy will be developed. This structured approach will result in information systems which eliminate redundancy, incompatibility and other system inefficiencies.

This planning and requirements definition process has been underway since December 11, 1989 for the functional groups addressing civilian payroll and for distribution centers. On March 7, 1990 the financial operations group commenced their review, and similar reviews are being initiated for the civilian personnel, materiel management, contract payments and medical functional areas. Additional functional areas will be identified and groups convened.

The Department of Defense is committed to achieving the goals of Corporate Information Management. Such an effort is needed to assist in reducing the number and cost of management information systems within the Department. Concentration on a Corporate Information Management approach will permit us to focus our efforts on designing well a limited number of systems rather than many systems of limited application and reliability. Corporate Information Management will permit the discontinuance of overlapping systems and result in improved functional business processes and quality of information.

Recent technology changes and the movement towards open systems, coupled with the personal involvement of the Deputy Secretary of Defense, now provide the opportunity for this dramatic change in approach to business systems planning. The Department does not have all of the answers yet, because these are the very early days of the Corporate Information Management efforts. Also, the processes in Corporate Information Management will evolve according to the expert assistance obtained and the experience gained through the CIM Executive Level and Functional Groups.

The DoD Comptroller, as tasked by the Deputy Secretary of Defense, has another major Defense Management Report initiative in process. This initiative will evaluate and determine the economic feasibility of further consolidating ADP operations and design activities in DoD. To accomplish this, a study team has been created and chartered to:

- Examine all feasible options, challenging the present way of doing business in order to improve efficiency and reduce duplication;
- Seek potential to reduce the operations and overhead costs associated with DoD Information Technology operations;
- Determine ways to improve receptivity for new technology and innovative management practices; and
- Develop a process to assure effective oversight of ADP Operations and Design Activities in DoD.

The DoD ADP Consolidation study team has completed its data gathering and is finalizing its analysis. The team will deliver an Implementation Plan to the Deputy Secretary of Defense by May 1, 1990.

While the Defense Management Report initiatives will result in substantial changes in the structure and alignment of ADP programs and services, let me assure you that the fundamental precepts of life cycle management as employed in DoD will remain essentially unchanged. Corporate Information Management is concentrating on the information systems development process with emphasis on the front end to assure that the functional strategic planning and requirements process have been precisely accomplished and are based on a firm foundation. The ADP Consolidation Study is concentrating on the operational aspects of our automated systems to identify opportunities for reducing current and future operating and support costs.

We appreciate the vigorous support this subcommittee has provided for the Department's life cycle management policy and for the oversight exercised by the Major Automated Information Systems Review Committee, commonly referred to as the MAISRC. In the time since I testified last year before this subcommittee, important changes have been made in both our policies and our program oversight. These changes further strengthen the effectiveness of the sound policy and program oversight processes which are in place. In the area of life cycle management policy, we have updated our instruction for oversight to incorporate direction from the Deputy Secretary of Defense and to address congressional concerns. The updated DoD-wide instruction and companion manual have been published. The instruction and manual govern AIS life cycle management review and milestone approval for all major and nonmajor AIS programs, including telecommunications programs and AIS programs for mission-critical applications. This clarification and consolidation of policy guidance should improve the Components' adherence to life cycle management principles.

Our oversight of major automated information systems consists of two major elements. First is the actual milestone reviews conducted by the MAISRC. Second is the sustaining oversight monitoring of major AIS programs, including those delegated to the DoD Components for milestone review.

As indicated by its name change, from Council to Committee, the MAISRC is a committee of the Defense Acquisition Board (DAB). The Comptroller continues to chair the MAISRC. The major AIS program thresholds are unchanged and the MAISRC continues to operate under procedures in use before the MAISRC became a committee of the DAB. However, MAISRC membership is expanded to include an additional official from the office of the Under Secretary of Defense for Acquisition. The scope of MAISRC oversight now includes telecommunication programs, in accordance with Deputy Secretary of Defense direction, and includes all command and control systems which primarily use commercial computer systems or their derivatives, based on the subcommittee's report on our FY 1990 budget request. The life cycle management review of the WWMCCS ADP Modernization program, a command and control program, took place in January 1990. The review of the WWMCCS ADP Modernization program was conducted as a joint DAB committee review by the MAISRC and the C3I Systems Committee.

DoD is strengthening its sustaining oversight processes by obtaining more thorough, pertinent, and timely data on information technology programs. The quarterly reporting on major AIS programs, which was begun in October 1988, has given OSD visibility to key AIS management indicators, such as certified cost and schedule data. These reports have proved to be an excellent method of tracking major AIS program progress, especially for those programs that have been delegated by OSD to the DoD Components for their review and milestone approval. Recently, we expanded quarterly reporting information to include ADP acquisition data, including pertinent Delegations of Procurement Authority from GSA. This data should assist in tracking acquisition strategies and initiating corrective actions earlier in the AIS program.

DoD has noted that major AIS program management contains complexities and unique situations not found in smaller or non-AIS programs. With these unique needs, we found that no educational or developmental program existed in government or the academic community to provide a framework, methodology, or practical context for major AIS program managers or their staffs. The DoD Comptroller and the President of the National Defense University have worked together for the past two years to solve this problem. The Information Resources Management College resulted from a joint effort by the National Defense University and the DoD Comptroller to reorient and upgrade the DoD Computer Institute. The effort transformed the level and focus of the curriculum and faculty. The first new courses on major AIS program management have already begun, with a full set to be offered by the end of FY 1991. The upgraded new college also offers assistance to IRM program managers and their staffs through the Technical Assistance Center. The high quality of the IRM College faculty enables DoD to develop and offer educational programs targeted to crucial management and technical IRM issues and to present these programs directly to the DoD commands or agencies involved. An example is the just-completed symposium series on the current regulatory environment for ADP acquisitions. The symposium series began in November 1989 and has reached 1500 ADP acquisition managers, contracting officers, and technical specialists at 19 DoD locations.

Also, we are continuing to work with the Office of Personnel Management (OPM) to improve recruitment and retention of our IRM professional work force. We have asked OPM to look into our proposal for an information systems manager job classification, and OPM has discussed with us the classification options available to address our IRM personnel issues. We are seeking to apply the techniques used to establish the IRM College curriculum to determine education, experience, and career progression requirements for all IRM personnel.

Information Processing Standards play an important role in AIS development. While DoD's Corporate Information Management efforts seek to increase standardization of the Department's internal information systems, DoD's Information Processing Standards (IPS) activities emphasize AIS interoperability within the DoD and among DoD, Federal Agencies, industry, and the international community. Through the use of IPS, vendor proprietary barriers to an open systems architecture can be reduced substantially or eliminated. This should serve to reduce the number of compatibility-limited ADP procurements throughout the Department. Information processing standards also have the potential to reduce the cost of making AIS changes and technology enhancements.

In parallel with the Corporate Information Management efforts to improve quality, consistency, and standardization of data, the Department is placing special attention on revitalizing the data elements standardization program for information systems within DoD. The data element standardization effort should simplify the sharing of data among systems, improve the precision of data, and reduce the necessity and cost for data translation among information systems. I have established a task group to develop recommendations to strengthen the process for departmentwide data management. Further, the group will recommend how the DoD data element standardization program can be integrated with strategic information system planning, information architecture development and interoperability requirements determination.

Mr. Chairman, you have before you our request for appropriations to support information technology in the Department. Automation is becoming an integral part of every employee's job and an essential mechanism for achieving management efficiencies described in the Defense Management Report. Both the DoD Comptroller, as our Senior Information Resources Management Official, and myself, as the Deputy Comptroller for Information Resources Management, take our resource stewardship roles very seriously. Especially during this period of tight defense resources, we must ensure our investments in ADP are prudent and produce well-defined results.

The Corporate Information Management initiative embodies the Department's commitment to achieve management efficiencies. Our life cycle management policies and procedures are aimed at minimizing oversight layering while controlling expenditures on new and modernized AIS programs. As with the steps recommended by the Defense Management Report, DoD's Information Resources Management initiatives will require commitment, cooperation, and sustained support from all parties involved in order to achieve long-term economies and to improve effectiveness of management of DoD programs. Mr. Chairman and members of the subcommittee, I solicit your continued support for our oversight and management improvement programs and for our Corporate Information Management and ADP consolidation initiatives.

OSD OVERSIGHT

Mr. MURTHA. Thank you, Ms. Kendall.

One of the things that has impressed me—I know you are proud of it now—is the possibility of saving $2 billion. I know you already took the money out, so it looks like a lot of people will be running short or they will actually be able to make the savings.

But a couple of things were pointed out to me in your statement, which impressed me, both with your office and with the Army, where we had too much trouble. I am impressed with the progress that has been made during the past few years. We had kind of a bad hearing last year, you may remember, and we know it is going to be a lot better, from all the information that we have gotten this year.

The committee understands that your office issues department-wide ADP policies, oversees the $9.5 billion annual ADP budget, and reviews the acquisition of hundred million or billion dollar computer systems. In short, you are the Department of Defense's top ADP expert. Is that right?

Ms. KENDALL. Yes sir.

Mr. MURTHA. Are you in the top 100?

Ms. KENDALL. I haven't met your stature yet, sir.

Mr. MURTHA. A Marine being the top in ADP sometimes is not necessarily a compliment.

What does your office do to manage these resources?

Ms. KENDALL. My office is responsible for a number of areas in information resources management. We issue information resources management policy for all the Department of Defense, and develop the life cycle management policy for automated information systems.

One of my major responsibilities is the oversight of automated information systems. To that end, I am sure you are familiar with our Major Automated Information Systems Review Committee, or MAISRC. My organization coordinates the staff support, and the Comptroller serves as Chairman of the MAISRC and approves milestones for major automated information systems. In addition to oversight activities by the MAISRC, my staff also conducts on-site reviews of programs within the Components. We also review quarterly reports received from the Components on these major automated information systems. In addition, my office reviews and scrubs the Component information technology budget submissions on an annual basis. We also participate in information processing standards committees to develop standards and promote standardization in the area of ADP. We also provide oversight and direction to the Information Resources Management College curriculum programs. But right now, my most important responsibility is carrying out the Deputy Secretary's initiative on Corporate Information Management.

Mr. MURTHA. What about your oversight responsibility?

Ms. KENDALL. Our office coordinates the staff report for the Major Automated Information Systems Review Committee. To that end, we work with other members across OSD as well as the Services, to review specific major automated information systems that come into our purview for review at specific milestones. In addition to reviewing systems at specific milestones, we also conduct in-process reviews of systems that we determine we need to take a look at.

CORPORATE INFORMATION MANAGEMENT

Mr. **Murtha**. For instance, the new system that you explained to us went into place when?

Ms. **Kendall**. You are speaking of Corporate Information Management?

Mr. **Murtha**. Yes.

Ms. **Kendall**. Corporate Information Management is really a broad overall concept. As we proceed with implementation and eventually identify specific individual programs and automated information systems, we will then move into following our life cycle management principles and policies and therefore, would be reviewing those systems by the MAISRC.

Mr. **Murtha**. A month or so ago, maybe several months ago, Secretary Atwood and Secretary Betti had me over and they told me what they were going to do the day they made the announcement. Are you pretty well along? Besides taking the money out, how far along are you right now?

Ms. **Kendall**. If I can go back, the original announcement occurred October 4. By December we had put in place our process. We convened two of our functional groups—civilian payroll and distribution centers. Since then, we have convened two more functional groups—civilian personnel and financial operations. In addition to starting those four functional groups, we have already convened meetings of our Executive Level Group and are well on our way to following through with that process.

Mr. **Murtha**. So the staff says you are doing the planning but you really haven't gotten the computer system yet. Is that right?

Ms. **Kendall**. It wouldn't yet be proper to jump into a particular technical solution at this time. We need to do the front end process of defining Defense-wide functional requirements first.

Mr. **Murtha**. So the savings are going to come at what stage in this process?

Ms. **Kendall**. The Department of Defense has already removed $288 million from the Services' fiscal year 1991 budget. However, we have retained a portion of that specifically for our CIM initiative. I have $100 million for CIM. As we move along in the process, we will be looking at individual functional areas and making specific decisions in those functional areas. In the meantime, we consider it very important to slow down some of those investments. That is the reason we pulled those funds out. As we go into the outyears we pull increasingly higher amounts of dollars out of the budget.

COMMAND AND CONTROL SYSTEMS

Mr. **Murtha**. What responsibility do you have for review of command and control systems?

Ms. **Kendall**. The Department of Defense is complying with the Committee's direction from last year to review command and control programs. For example, the WWMCCS ADP modernization program was the first command and control program handled under this guidance. It was reviewed jointly by the MAISRC and the Defense Acquisition Board's (DAB's) C3I Systems Committee this past January. My staff and the staff of the C3I Systems Committee are in the process of identifying other programs for review.

Mr. **Murtha**. Do you have any limitations—are there any limitations at all?

Ms. **Kendall**. At this juncture, we consider command and control under our purview, but we need to work in a way that makes sense with the C3I Systems Committee and determine how best to review these systems.

ARCHITECTURE REVIEWS

Mr. **Murtha**. A couple of years ago the Committee directed that OSD review the Services ADP architectures for strategic plans. How have you complied with this requirement?

Ms. **Kendall**. My office has conducted informal reviews of the ADP architectures and strategic plans and issued some informal guidance. We are moving toward a proper framework essential to performing effective architectural reviews. Our current framework is for reviewing individual automated information system programs and information technology budgets. But performing ADP architecture reviews is a larger and more complex issue. The Department is working to set up a proper framework through the Executive Level Group.

Just as our review process is moving from an individual system scope to an entire business area scope with Corporate Information Management, we are positioning ourselves to perform broader Service architecture reviews.

SERVICE MANAGEMENT PLANS

Mr. **Murtha**. Last year we directed the Secretary of Defense to submit his plans for fixing the chronic Army and Navy management problems by April 1 of this year. I understand we haven't received those reports at this point?

Ms. **Kendall**. That is correct. We are prepared to submit within the next several weeks a report which addresses the Secretary's plans for resolving the Army and Navy ADP management problems identified by this Committee. Our report will contain a summarization of actions taken to improve information technology management, development and operations departmentwide. These include the Defense Management Report-related actions and ongoing management oversight processes such as the MAISRC and automated information system program tracking.

Our plan will also contain individual sections on Army and Navy management improvement plans for correcting their specific ADP management problems. I have with me a number of pages listing specific actions taken which I will discuss now or provide for the record.

Mr. **Murtha**. Put it in the record.

Thank you very much.

[The information follows:]

Details on actions by the Army and the Navy to correct ADP management problems follow:

Army Actions to Improve ADP Management

Listed below is a series of actions taken by the Army to correct specific ADP management problems identified by the Congress:

Problem 1: Strengthen internal ADP management organizations

- •• Established an Information Mission Area Assistance Team to conduct on-site reviews and provide assistance to Major Commands (MACOM's) to improve MACOMs' management of AIS resources.
- •• Issued Life Cycle Management (LCM) policy in Army Regulation (AR) 25-3, November 27, 1989, and lowered thresholds from $50 million to $10 million program cost for Army MAISRC approval.
- •• Required MACOM's to conduct MAISRC-like reviews for systems with thresholds between $2.5 million to $10 million.
- •• Expanded the role and authority of the Architecture Control Committee (ACC). ACC, composed of senior officials, reviews all new requirements that cut across functional and MACOM boundaries.
- •• Established SES Technical Advisor and Civilian Special Assistant positions in the DISC4 for continuity of leadership.
- •• Formulated a strategy to use the National Defense University IRM College, the Management Engineering College (AMEC) and other sources to train AIS program managers.

Problem 2: Mechanisms to rigorously define and screen user requirements

- •• Planning to publish DA Pamphlet 25-2, on the Information Mission Area (IMA) Planning Process. DA Pamphlet 25-2, projected for issuance in mid-1990, emphasizes planning and discusses the methodology to identify deficiencies and formulate Requirement Statements (RS).
- •• Developed Army Modernization Plan for Sustaining Base Automation, which categorizes and prioritizes sustaining base automation programs.
- •• Required MACOM's to establish requirements validation procedures for requirements approved at their level.
- •• Defined thresholds for levels of approval authority with visibility to HQDA of any MACOM-approved RS's provided via the submission of the MACOM IMA Modernization Plan.

- •• Notified MACOM's that all RS's greater than three years old will be canceled effective July 1, 1990, and provided criteria for resubmission and approval.

- •• RS's requiring approval at HQDA level will be reviewed by the Army Architecture Control Committee, with DISC4 as the approval authority.

Problem 3: Comprehensive base level information architecture

- •• Published Army Information Systems Architecture (Circa 1997), August 29, 1989 which defines the installation architecture and includes such objectives as:

  (1) Emphasize common user systems and provide user access to all required common user services from a single workstation;

  (2) Use of open system standards (OSI, IEEE, FIPS, ANSI, CCITT, etc); and

  (3) Use of standard data elements and separate data from applications.

- •• Published AR 5-3, which details Army policy for building a standard installation level management information system.

- •• Developed the Army Strategy for Sustaining Base Automation which mandates transition to Open System Architecture (OSA).

- •• Designated the Sustaining Base Information Services (SBIS) as a major program to execute Army's open system architecture strategy by acquiring common user OSA platforms to support the installations and echelons above.

- •• Developed an Installation Information Model (IIM) as the cornerstone for building integrated and interoperable information systems at installation and echelons above.

- •• Developed Installation Support Modules (ISM) Project to standardize automation of the installation functions defined in AR 25-3, eliminate costly software duplication, drive out unique software applications, and provide data sharing among users at installations and echelons above.

Problem 4: Competitive acquisition strategy

- •• Published "Army Strategy for Sustaining Base Automation," (October 1989) which establishes the management strategy prioritization and control-of-investment issue:

  (1) Priority 1 - keep the existing baseline operating;

  (2) Priority 2 - emphasize modernization of capabilities; and

  (3) Priority 3 - renew existing capabilities based on maintenance of acceptable support and services to MACOM's and functional proponents.

- •• Developed Army Modernization Plan for Sustaining Base Automation. Modernization Plan is fiscally constrained by current Army guidance.

- •• As part of IMA planning process, required MACOM's and functional proponents to develop resource-constrained modernization plans.

Problem 5: Limit software development to the minimum mission essential

- •• Published a series of 25-Series Army Regulations that address Army's policy, guidance, and standardization needed to interface computers and develop portable software leading to an open systems environment.

- •• Implemented Army's SBIS program to support movement to an open system environment and further eliminate software development costs associated with duplicative developments.

Navy Actions to Improve ADP Management

Listed below is a series of actions taken by the Navy to correct specific ADP management problems identified by the Congress:

Problem 1: Strengthen internal ADP management organizations

- •• Established Under Secretary of the Navy as the SECNAV focal point for all Department of the Navy (DON) ADP matters, including organization, requirements and resources.
- •• Established Assistant Secretary (Research, Development and Acquisition) as the DON Senior IRM Official and has policy and oversight authority for development and acquisition of information systems.
- •• Merged information systems and telecommunications into a single division in the Office of the Chief of Naval Operations, thereby reducing duplication in data communications while increasing cost-effective management response to operational requirements in information processing.
- •• Merged the Naval Data Automation Command and the Naval Telecommunications Command as second echelon field headquarters.
- •• Continued study of the Program Executive Officer (PEO) concept for major automated information systems. Implementation of the PEO concept would bring the management, oversight, and responsibility for the development and execution of major AISs under one authority;
- •• Continued consolidation study of the Navy ADP Selection Office and Naval Commercial Communications Center. Joining of these activities is judged likely. Study is projected for completion in October 1990.
- •• Establish by October 1990, a benefits review team to provide independent verification of promised benefits for major AISs.

Problem 2: Mechanisms to rigorously define and screen user requirements

- •• Established DON information resources planning system to permit functional sponsor, command, and IRM review and approval of major user requirement before systems development starts. The LCM discipline provides for revalidation of stated requirements.

- •• Established DON Information System Executive Board which reviews all major information systems projects, including user requirements.
- •• Entered into contractual agreement with the Federal Systems Integration Management Center (FEDSIM) to provide independent reviews of function and technical requirements analyses as well as specification reviews. Under the DON/FEDSIM agreement, FEDSIM will review acquisition-related documentation and studies, to include (1) MENS, (2) Requirements analyses, (3) SDP's, (4) Technical specifications and (5) Cost/benefit studies.
- •• Establish by October 1990 an Information Systems Requirements Board to increase the discipline within the requirements determination process.

Problem 3: Comprehensive base level information architecture

- •• Established a base level information architecture covering landlord functions for bases and stations through issuance of OPNAV Notice 5231, dated April 18, 1989.
- •• Issued OPNAV Instruction 2800.3 which established a top-down base level architecture to provide a communications platform as a utility for standard information systems.
- •• Plans to revise OPNAV Instruction to include the Marine Corps and support development of base communication plans necessary for development of data/voice competitive specifications for replacement of currently leased switches and cable plants by April 1991.

Problem 4: Competitive acquisition strategy

- •• Plan to obtain required resources from competitively awarded umbrella contracts either awarded or in process (For example, Z-248, ULANA, Desk Top III).
- •• No requirement is anticipated for new contracts specific to the base architecture effort.

Problem 5: **Limit software development to the minimum mission essential**

- Issued data call to functional sponsors to identify information systems by functional area and where common functionality exists.
- Establish by October 1, 1990 an Information Requirements Board that will perform the front-end function of ensuring that only those systems which are truly mission essential and not duplicative, proceed to development and execution.

CORPORATE INFORMATION MANAGEMENT

Mr. **MURTHA**. One of the things that Secretary Atwood talked about when we had our meeting was the initiative to eliminate the development of Service-unique ADP systems in favor of common or shared systems. We have had some experience with this. If you can work this out, I will be amazed, because it does not happen even for airplanes that are used in common. Obviously there are legitimate differences in many of these programs, but it seems in the field that you are involved in, we could make some progress, and I think save substantial amounts of money.

I don't know that we should be optimistic, as optimistic as Secretary Atwood is, and take the money out now, but certainly enormous sums could be saved, or it seems to us on this committee, if this works. Would you explain in terms that I could understand what the Corporate Information Management initiative is and what military functions will be covered?

Ms. **KENDALL**. There are several basic premises in our Corporate Information Management initiative. One of those is to increase the standardization, quality and consistency of our data across the Department of Defense. We also need to improve our management efficiencies in our business areas throughout the Department. The one you mentioned previously is that we need to eliminate duplication of efforts in the development of multiple information systems that support or meet a single functional requirement.

Mr. **MURTHA**. Could you give us an example of what you are talking about, a system that you are trying to develop a shared interest in?

Ms. **KENDALL**. One of the functional groups we convened in December was civilian payroll. At the current count we find we have 27 civilian payroll systems in the Department of Defense. I would contend that we don't need multiple individual systems with individual staffs supporting those systems, making improvements, maintaining and operating those individual systems. I believe we have a vast opportunity to reap some savings across the Department.

Mr. **MURTHA**. Give us the range of those systems so that we can understand. I would probably not understand the technical things but give us the range of the most primitive to the most unique system you have, just the differences between them?

Ms. **KENDALL**. You are talking in terms of just the civilian payroll or DOD-wide?

Mr. **MURTHA**. Civilian payroll. For these 27 different types, what would happen?

Ms. **KENDALL**. I would contend that each of those 27 systems are indeed paying our people and close to on time. They are serving the functional requirement they are intended for.

Mr. **MURTHA**. How did that come about? One might be 25 years old where one is a more modern system. I am trying to get a feel for why we would have 27 different systems.

Ms. **KENDALL**. I would say the reason is the way the Department of Defense has evolved and the way we have developed automated data processing systems in the past, in a more decentralized manner. We need to put top level management attention on this issue, which is what the Corporate Information Management initiative is intended to do.

Mr. **Murtha**. So you are not saying they came about because they just developed that way, it is just the way that the Department of Defense operates. These folks have always traditionally paid their people this way and nobody ever looked at the possibility of using the same system?

Ms. **Kendall**. Essentially. Broad management policy was disseminated but each organization was responsible for carrying out their mission. In order to pay their people eventually they would move toward automation. We had all those separate systems developed.

Mr. **Murtha**. Who are you talking about, the Air Force, the Navy, Corps of Engineers?

Ms. **Kendall**. Also Defense Agencies, and Office of the Secretary.

Mr. **Murtha**. All Defense Agencies would be paid by the same organizations?

Ms. **Kendall**. Not today, sir. There is not a single payroll system. In some cases the agencies share, but not in all cases. We are starting from the top level and pulling in members from the Army, Navy, Air Force, and Defense Agencies to discuss civilian payroll. If the one organization is doing it slightly different from the next organization, we'll discuss the possibility of doing it the same way.

Mr. **Murtha**. Civilian payroll—so you will not include the military in this?

Ms. **Kendall**. The military has civilian employees, people from the Military Departments who are knowledgeable in the civilian payroll functional area will be participating.

Mr. **Murtha**. So you are talking about only civilian employees, not the military pay at this stage or are they also going to be included?

Ms. **Kendall**. Eventually we would be addressing that particular functional area. We have not yet convened a group.

Mr. **Murtha**. This will be for civilian employees of the Department of Defense?

Ms. **Kendall**. Yes.

Mr. **Murtha**. That covers how many people?

Ms. **Kendall**. About a million.

Mr. **Murtha**. How many different agencies?

Ms. **Kendall**. All of the Services as well as all Defense Agencies.

Mr. **Murtha**. When you say the Services, that is civilian employees of the Services?

Ms. **Kendall**. Correct, and civilian employees of the Defense Agencies and the Office of the Secretary of Defense.

Mr. **Murtha**. So there are 27 separate civilian pay systems for the Defense Department. How many then in the military part of it?

Ms. **Kendall**. The count of 27 individual ADP civilian payroll systems is across all of Department of Defense currently and I don't know the exact number of military payroll systems.

Mr. **Murtha**. In the military, not civilian, but the military pay area, how many more would there be for military pay?

Ms. **Kendall**. I don't have that, sir.

Mr. **Murtha**. Put that in the record.

[The information follows:]

DoD has a total of 14 systems for military pay. The number of systems for military pay for each of the Services is as follows:

Army.—The Army has three payroll systems, one for retired military (Joint Uniformed Military Payroll System—Retired Pay (JUMPS-RP)), one for the Active Component (Joint Uniformed Military Payroll System—Active Army (JUMPS-AA)) and one for the Reserve Components (Joint Uniformed Military System—Reserve Component (JUMPS-RC)). The retired pay is the disbursement of a pension annuity and functions under a different set of rules and laws from the Active and Reserve Components. The Army is in the process of replacing both the JUMPS-AA and JUMPS-RC with the single pay system developed and maintained by the Air Force. This will be a joint Service effort the Army refers to as the Military Pay Redesign—Joint Service Softwise (MPR-JSS). At that time the Army will have only two pay systems, MPR-JSS and JUMPS-RP.

Navy.—The Navy has nine systems which process military pay. These systems were designed to satisfy separate legal and operational requirements; e.g. Naval Academy Midshipmen, Armed Forces Health Professional Scholarship Program, Active Duty Pay, Reserve Pay etc.

Air Force.—The Air Force has two primary military pay systems, the Joint Uniform Military Pay System (JUMPS) and the Casualty and Annuitant and Retired Pay System, as reported in the Air Force Annual Statement of Assurance required under the Federal Managers' Financial Integrity Act (FMFIA) of 1982. The JUMPS system includes the following modules:

Air Reserve Pay Allowance System.
Trainee Military Pay System.
ROTC Instructor Pay System.
ROTC Summer Camp Payroll System.
Air Training Command ROTC Cadet Pay System.
Air Force Academy Cadet Pay System.

Mr. **Murtha**. What military functions won't be covered in the development of this system?

Ms. **Kendall**. Well, initially we plan to address administrative-type systems. As we proceed, we are asking the Executive Level Group to define a scoping of the Corporate Information Management initiative. Eventually we will have a better idea of the scope. I do not envision that we would be including computers embedded in weapons.

Mr. **Murtha**. How much money are we talking about to make the initial investment here?

Ms. **Kendall**. For Corporate Information Management itself, we have requested $100 million in fiscal year 1991. That is in contrast to the $288 million we have pulled out of the Service Departments' budget.

Mr. **Murtha**. So you are using part of that $288 million to start the system?

Ms. **Kendall**. That is correct.

Mr. **Murtha**. So you save $188 million?

Ms. **Kendall**. That is correct, in fiscal year 1991. As we proceed in the outyears, we estimate a net savings of $2.2 billion.

Mr. **Murtha**. But we have already saved, you have already turned back to us $188 million, or asked for $188 million less?

Ms. **Kendall**. That is correct.

Mr. **Murtha**. In the next five years it will be $2.17 billion. Is that right?

Ms. **Kendall**. Yes, $2.17 billion. There are a couple of pieces that have been tied into our central fund that we are retaining dollars on. I can talk to those if you wish.

Mr. **Murtha**. Talk about the system itself. Are you starting from scratch? Are you going to build on one of the systems that you have in place? There must be one of these 27 systems, or maybe you have several systems, that are the same and can be coordinated. Do you know yet where you are going to start?

Ms. **Kendall**. We don't feel that we are starting from scratch. We plan to the maximum extent possible to capitalize on the functionality of existing information systems to meet our needs. We feel strongly though that we need the functional groups in our process to take a long hard look at what they consider our defensewide functional requirements to be. Then we will assess the existing systems to determine to what extent those systems meet our defensewide requirements.

Mr. **Murtha**. So it looks like you are talking about the possibility of adapting some of these systems to the overall system, is that right? Or are you going to have a completely new centralized system?

Ms. **Kendall**. I would envision the distinct possibility that we may identify an existing system that meets a large percentage of what we define as our defensewide requirements.

CIM FUNDING

Mr. **Murtha**. One thing that worries me, when we start cutting back, we always have a tendency not to put enough money aside for something that is a unique development. You are looking at a substantial savings. We don't want a gold-plated system, but are you taking enough money to make sure that this system works? One of the things that will make sure it doesn't work is if you don't set aside enough funding to be able to do what you say you are going to try to do.

Ms. **Kendall**. We believe $100 million in fiscal year 1991 is sufficient for our startup. As we go to years beyond, you will be seeing increases in the central fund as we ramp up our initiative.

Mr. **Murtha**. Do you have enough money to do what you say you are going to do without getting into a gold-plated system?

Ms. **Kendall**. I think this gives us a good start for our initiative in fiscal year 1991.

CIM PROCESS

Mr. **Murtha**. One of the things we have found over the years when we start looking at this—and I give the staff a lot of credit for hard work in this field. I said before Mr. Young and Mr. McDade came in, also that this young woman has done an outstanding job in this field, which was so fouled up. Our staff deserves a lot of credit for what has happened in this regard.

One thing we find when you start buying computers is some of the people either don't know what they are doing, or they don't buy the right system. How will CIM address this problem?

Ms. **Kendall**. Our basic premise is to take a strong look at our up-front process. In the past, GAO, Committee reports, and our analysis has indicated that most of the problems we experienced can be traced back to the early planning stages. Our initiative is particularly focused on those early planning stages. We intend to simplify our business practices in our functional areas, as the basis for consolidation and definition of our functional requirements.

As we proceed through the initiative, we will be following our own life cycle management policies and procedures, as we move toward final implementation. We feel that our approach to review and to simplify the business practices and consolidate functional requirements should provide us the ability to control essential management requirements and to avoid a plethora of technically driven requirements.

Mr. **Murtha**. The $64 question is how are you going to convince these Services to cooperate? I want to get this on the record so that I can pass it around to the other Members and I am going to send it over to other Committees. We have had some limited success, but I want to see how you are going to do this.

Ms. **Kendall**. I think in this day and age the pressure of reduced resources in the Department of Defense is perfectly clear. The Department wishes to maintain its mission capabilities. Across the Military Services and Defense Agencies, they are participating integrally in the CIM planning and decision making process. Thus, they are a part of the process, and a part of our decision making on defining our defensewide functional requirements.

This is going to provide a high degree of validity and commitment to the products of our Corporate Information Management, and ultimately, we will have defensewide functionally driven requirements, driven by the Services and Defense Agencies.

Our net savings that we have already instilled into our budget reinforces our commitment to Corporate Information Management. The Defense Management Report's emphasis on simplifying the business operations and reductions in non-value added work creates an environment for moving towards common systems for common functions.

What I have found over the last few months is there is a consensus that there is a need for Corporate Information Management. We do need to move toward eliminating Service-unique systems and move toward reaping the advantages of common systems.

Mr. **Murtha**. It sounds like, in listening to your testimony, and listening to what our staff said about the way you worked, you are coming up with a plan and you are taking the money away from the agencies that you are involved with. Then you are putting it into a program which they will have to be involved in. That is what it sounds like. You are trying to assure that that program will be a satisfactory program.

That might oversimplify it, but that is what it sounds like you are doing to me, and I think it may work. We have to fund more efficiencies, and we appreciate what you are doing in that regard. Mr. McDade.

COMPUTER MAINTENANCE

Mr. **McDade**. Thank you, Mr. Chairman.

Welcome again, in your second appearance before the committee. We are delighted to have you here and grateful for the cooperation that exists between us. We think you are doing a fine job.

A June 1989 Department of Defense IG report contained disturbing findings about computer maintenance contracts, for which the Department of Defense spends over $1 billion annually. The report states that "maintenance support to general purpose computers cost over $100 million more than necessary in fiscal year 1988." For this reason, our Appropriations conference reduced the fiscal year 1991 Department of Defense ADP budget by $90 million—$30 million in each Service.

Please discuss the major Department of Defense IG findings, and tell us what the problem is.

Ms. KENDALL. The IG, with support from the Air Force Audit Agency, and the Army Audit Agency, as well as the Naval Audit Service, performed an audit of maintenance support to general purpose computers in the Department of Defense. The audit was performed from November 1986 to June of 1988 and was undertaken to determine if maintenance support to general purpose computers was cost-effective, adequately planned and performed and effectively monitored and controlled in the Department of Defense.

The audit showed that maintenance support for general purpose ADP was not cost-effective, adequately planned or performed, or effectively monitored and controlled by the Military Departments and Defense Agencies. The audit findings indicated that over $100 million in maintenance costs could have been saved in fiscal year 1988 by maintaining and using reliable maintenance repair records to support maintenance decisions, by consolidating maintenance contracts, by centrally contracting for maintenance.

Mr. McDADE. Have those recommendations been implemented?

Ms. KENDALL. We have taken a number of steps. The Comptroller issued guidance to the Service Senior IRM officials and Directors of Defense Agencies in January 1988 to take those actions necessary to correct identified weaknesses.

We emphasized the importance of seeking increased competition, selecting the most cost effective maintenance options, and actively monitoring the contract maintenance services performed. I can cite a number of areas across the departments, if you wish at this point in time, or I can provide them for the record.

Mr. McDADE. Put them in the record and tell us if you think this problem is being adequately addressed.

[The information follows:]

The DoD Comptroller is strengthening its oversight processes, including maintenance management, by obtaining more thorough and timely data on ADP programs. The DoD budget submission separates ADP hardware and software maintenance costs. Budget requests now delineate funding for operations, including maintenance, and funding for development, including actions to modernize, enhance, expand, or add functions to present systems or to acquire new systems.

The Army issued Circular 25-89-1 (February 1989), which focuses on competition, cost effeciveness, and monitoring of ADPE maintenance contracts. Also, Army's Regulation 25-1, focuses on centralization of maintenance contracts and planning, and centralizes on-base management of maintenance for small computers.

DLA's 4700 Regulation series focuses on competition, cost effectiveness, monitoring, and maintenance planning. DLA has also centralized several of its maintenance contracts for microcomputers.

The Navy has reduced its computer maintenance costs by switching from on-call service to per-call service, annually reviewing reliability of the computers being maintained, and adjusting maintenance requirements accordingly. Maintenance contracts have been consolidated, where possible, to take advantage of economies of scale. In addition, the Marine Corps has centralized ADPE maintenance at the regional level.

Air Force Commands have changed from on-site or on-call to per-call maintenance. In addition, the Air Force is revising its regulations to provide more emphasis on the review of maintenance planning during its annual ADPE reviews. The Air Force is also examining other economic measures such as bundling of maintenance requirements; this will permit better use of competition.

The DoD policy base is appropriate and adequate. Problems arise when there is a lack of awareness of the policy and proper procedures. We have made improvements to the education and training of ADP contracting officers and program managers to avert problems in ADP maintenance management in the future.

Ms. KENDALL. I think we have made substantially inroads, but I would submit that we could continue to work on improvements.

Mr. McDADE. What is budgeted in fiscal year 1991 for computer maintenance and how does it compare to the fiscal year 1990 proposed level?

Ms. KENDALL. At this time, I would like to provide those specific numbers for the record.

Mr. McDADE. Also provide the funding for each Military Service and Defense Agency in FY 1990 to 1991 for computer maintenance, please.

[The information follows:]

The DoD total budgeted for FY 1991 for ADPE maintenance is $1.1 billion, or 6.8 percent above the proposed level for FY 1990.

Funding for the Military Services and Defense Agencies in FY 1989 to FY 1991 for ADPE maintenance is as follows:

[In thousands of dollars]

Service/Agency	Fiscal year—		
	1989	1990	1991
Army	295,233	338,193	373,309
Navy	224,801	227,462	253,323
Marine Corps	14,850	25,252	23,665
Air Force	269,961	355,072	352,060
DLA	36,833	30,018	38,840
OSD	6,969	11,567	12,799
DMSA	3,911	7,666	9,559
DCA	6,462	7,555	8,033
DMA	5,886	8,182	7,997
OCHAMPUS	5,758	5,087	5,211
OJCS	3,905	4,099	4,936
DCAA	1,859	3,139	3,582
Other agencies	2,547	2,708	2,886
DOD Total	878,975	1,026,000	1,096,200

Mr. McDADE. How much is projected as savings in fiscal year 1991 due to improved management practices as a result of the IG's findings?

Ms. KENDALL. I would have to solicit specific responses from the Military Departments.

Mr. McDADE. Put that in the record by each individual Service and Defense Agency.

[The information follows:]

The following projected savings occur in FY 1991 due to improve ADP maintenance management practices:

Army: The increase in maintenance funding for FY 1991 is consistent with the Army's fielding of systems and increased dependence on automation to accomplish assigned missions with reduced personnel resources. The Army's ADPE inventory has increased from over 17,000 items of equipment in 1984 to over 544,000 in 1989. However, maintenance costs, including inflation, have not increased proportionately with the increase in inventory.

Navy: Projected FY 1991 savings for the Navy is $37 million, as follows:

	millions
Command:	
Naval Supply Systems Command	17.3
Naval Regional Data Automation Centers	3.2
Chief of Naval Operations	3.0
Naval Sea Systems Command	2.5
Chief of Naval Education and Training	2.4
Asst for Admin., Under Secretary the Navy	2.2
Space and Naval Warfare Systems Command	2.0
Commander, Naval Oceanographic Command	2.0
Others	2.4
Total	37.0

Navy reduction is shown in the FY 1991 President's budget submission. These savings were accomplished by switching from "On-call" service to "per call" service, annually reviewing reliability of the computers being maintained and adjusting maintenance requirements accordingly. Maintenance requirements have been consolidated, where possible, to obtain economies of scale when satisfying these requirements.

Air Force: The Air Force expects significant savings in FY 1991 and has requested ADP maintenance funding of $352 million vice $445 million projected for FY 1991 in the FY 1990/1991 revised Bush budget submission. This is $3 million less than the $355 million appropriated in FY 1990.

Defense Logistics Agency: The FY 1991 maintenance funding reflects an estimated savings of $1.5 million, which DLA will achieve by more effective maintenance management. The improvements include usage of per-call maintenance rather than principal-period maintenance on items that are not critical to the mission. Efforts are underway to improve the terms and conditions of existing and future requirements to provide more flexibility to managers in choosing the most cost-effective maintenance.

LIBRARY OF CONGRESS

Mr. McDade. Last year the Committee discussed with you contract abuses by Department of Defense organizations through the Library of Congress—in large part for ADP equipment and services—that were aimed at short-cutting the procurement process and avoiding competition. A February 1990 Department of Defense IG report confirms there had been abuses on $83 million of Department of Defense contracts in fiscal year 1988.

Miss Kendall, please tell us about the Department of Defense IG findings.

Ms. Kendall. The IG identified $83 million in total interagency transfers from the Department of Defense to the Library of Congress. This included appropriate uses of the FEDLINK contracting vehicle. However, contracting officers should have been, but were not always, involved in these interagency agreements.

Our Assistant Secretary of Defense for Production and Logistics is working on this as a broad acquisition issue as this is not restricted solely to automatic data processing.

Mr. McDade. Can you kind of flesh out what you think were the Department of Defense regulations and/or the policies that permitted that situation to occur?

Ms. **Kendall.** We have examined our acquisition policies and regulations and consider them to be appropriate and adequate. However, I think the problem is more in the area of lack of awareness of internal controls that contributed to this situation. We do have some corrective actions that are being worked on. At this time, since it is under the purview of the Assistant Secretary of Defense for Production and Logistics, they are currently preparing a formal response to the Department of Defense IG, and will include those corrective actions.

Mr. **McDade.** Any idea what the timeframe is?

Ms. **Kendall.** I would say within a couple of weeks.

Mr. **McDade.** I am sure you will share the information with our staff.

[The information follows:]

The formal response was submitted to DODIG on May 10, 1990. A copy of the response has been forwarded to the Committee.

Mr. **McDade.** Two years ago, our Committee's Surveys and Investigations Staff found similar ADP contracting abuses between Department of Defense organizations and the Department of Energy's Oak Ridge facility, which wasted over $40 million annually. Tell us just exactly what is going on. Were they just transferring illegal contracts over from the DOE to the Library of Congress?

Ms. **Kendall.** Surveys and Investigations identified a number of problems in the use of DOE for contracts with the Department of Defense. We have taken substantial action to resolve those particular problems. However, we have not identified a trend where contracts were specifically transferred from DOE to FEDLINK.

Only one instance where a particular project may have been taken out of DOE and then moved to FEDLINK was found, but that was an isolated case.

Mr. **McDade.** Most of it was just improper, inadequate management, is that what you are saying?

Ms. **Kendall.** Correct.

Mr. **McDade.** Did you indicate that with respect to the DOE you were further along in solving that internal management problem?

Ms. **Kendall.** We put out substantial guidance a year ago on the use of DOE's facilities. We have had multiple meetings with the Services, and I think we have a clear understanding of the appropriate use of those facilities.

Mr. **McDade.** Last year the Committee reduced the ADP budget by $15 million due to the Library of Congress contract abuses. Can you tell us how the reductions of $15 million were applied?

Ms. **Kendall.** I have substantial information on where the total reductions for fiscal year 1990 were applied, but I don't have the specifics on the $15 million.

Mr. **McDade.** Furnish that for the record, please.

[The information follows:]

Application of the $15 million by Service is as follows:

Army: The Army's reduction ($5 million) was spread equally throughout the Army.

Navy: The Navy's reductions were applied as follows:

Area	*Millions*
Chief of Naval Operation	$1.15
Naval Air Systems Command	1.25

Area	*Millions*
Naval Oceanography Command	1.20
Naval Sea Systems Command	1.40
Total	5.00

Air Force: The Air Force's reductions ($5 million) were all taken in funding for ADP contract commercial services. Approximately half was split equally between Air Force Logistics Command and Air Force Systems Command. The rest was spread to several other commands.

Mr. McDADE. What do you think the savings are that are going to result from the fiscal year 1991 ADP budget as a result of the Department of Defense IG findings? Are they going to see any concrete savings that you might be able to identify for the committee?

Ms. KENDALL. If you are discussing this in terms of FEDLINK, I would submit that as we put together our budgets we are budgeting funds for specific requirements. We do not at the time we budget necessarily identify the contracting vehicle we will use. Funds that are budgeted are for specific programs and requirements. I don't specifically identify a particular savings due to reduced use of FEDLINK.

Mr. McDADE. It seems to us that if the acquisitions are being better managed and done in a more intelligent way, there ought to be some savings resulting from that.

Ms. KENDALL. If we have increased competition, we would anticipate some savings. However, we budget for our estimates of what it is going to take to carry out these programs.

Mr. McDADE. Have you been able to reduce the budget estimates through efficiencies or are they up or static, or where are they?

Ms. KENDALL. In general, when the Comptroller's organization scrubs the Services' requested budget in the fall, we take a long hard look at each individual item. We consider those amounts appropriate for those programs.

Mr. McDADE. Am I to take it from the response that the Department isn't able to demonstrate any savings, that there is a zero saving amount that results from all this activity?

Ms. KENDALL. I think I would be remiss if I said the answer is yes, to say we would have estimated, in view of less use of FEDLINK, a lower number. We haven't looked at the budget from that viewpoint.

Mr. McDADE. Would you take a look at it and give us your best response and professional opinion for the record?

[The information follows:]

The DODIG's audit report "Contracting Through Interagency Agreements with the Library of Congress" states that inappropriate use of interagency agreements with the Library of Congress may have resulted in excessive contract prices. However, the audit report lists potential benefits resulting from the audit as nonmonetary and nonquantifiable.

While monetary benefits are not separately quantified in the report, procedural improvements have taken place that will ensure that increased competition and thus, lower pricing, will occur. The FY 1991 budget was developed with the assumption that competition in acquisitions will take place to the fullest extent possible.

Mr. McDADE. Also, provide for the record each Service and Defense Agency in FY 1985 to 1991, the Department of Defense funding that was executed through the Library of Congress.

[The information follows:]

Most of the interagency agreements between DoD Components and the Library of Congress in FY 1985 to 1991 pertain to information services for DoD libraries. Of the more than 100 contractors providing services through the Library of Congress, only eleven were found to warrant investigation by the Library of Congress. The estimated DoD aggregate funding executed through these eleven is shown below, by year:

Fiscal Year	*Amount*
1987	$5,727,676
1988	41,774,830
1989	4,936,120
1990	295,626

The DODIG reviewed the interagency agreements for FY 1987 and 1988 and identified questionable uses totaling $1.53 million in FY 1987 and $18.34 million in FY 1988, based on the highest dollar-value interagency agreements. Subsequently, strong actions have been taken to ensure present and future interagency agreements are proper, as indicated by the sharp downward trend in FY 1989 and 1990. Detailed data is available on funding for usage by Service and Defense Agency for the two latter years and is as follows:

Service/Defense Agency	Fiscal year— 1989	Fiscal year— 1990
Army	$1,555,289	$6,560
Navy	2,566,673	261,195
Air Force	525,779	27,871
DLA	65,120	0
DNA	218,059	0
OSD	3,000	0
DTSA	2,200	0
DOD Total	4,936,120	295,626

Mr. McDADE. Thank you very much.

Thank you, Mr. Chairman.

Mr. MURTHA. Mr. Young.

MEDICAL ADP

Mr. YOUNG. Thank you, Mr. Chairman.

Ms. Kendall, what is the status of the Composite Health Care System?

Ms. KENDALL. The Composite Health Care System is proceeding well along in its development. It is currently in operational test and evaluation. We are testing at 14 individual sites. We anticipate a Milestone III review for deployment this fall, and hopefully will continue to proceed with deployment at the time.

Mr. YOUNG. Are all 767 hospitals and medical facilities involved at this time?

Ms. KENDALL. At this time, since we are at operational test and evaluation, we are only working with 14 sites.

Mr. YOUNG. Give me an idea of what kind of a track this program is on.

Ms. KENDALL. We feel it has been proceeding very well under the leadership of the Deputy Assistant Secretary of Defense for Health Management Systems. I think our question goes beyond this fall when, assuming that things proceed well, the MAISRC approves the program for deployment. We would then proceed with deploying the Composite Health Care System on an orderly basis to the total 767 sites.

Mr. Young. Congress placed a $1.1 billion constant dollar life cycle cost cap on the program. Since you are only involved in the first 14, has this had any effect at all one way or the other?

Ms. Kendall. That cost cap is over the life cycle of the program, so at this stage we have mandated that the program remain within that cost cap. To date it is not causing us any problems.

Mr. Young. How do you program for that cost cap when it is intended to apply to the whole program but you are only dealing with the first 14 facilities at this point? Do you have to prorate it somehow?

Ms. Kendall. Part of our life cycle management policies and procedures involve performing cost estimates on our programs over the life cycle. What we have done is in terms of estimating the total program cost across the life cycle. It is across many years and it will ultimately include the 767 sites. The $1.1 billion is a cost cap over the entire life cycle. We must, because of that cap, manage that program and stay within that cap.

Mr. Young. Now, we understand that the Department of Defense has recently changed its regulations for computing the ADP system life cycle costs. How does this affect the CHCS and your cost cap?

Ms. Kendall. With all due respect, I understand the issue being raised is not a matter of us changing our regulations. It is a matter of the program management for Composite Health Care System taking a look at the way they have defined their program and choosing to extend the life cycle to accommodate what they consider a better approach to that program to accommodate a mid-cycle technical upgrade to the system.

They have extended the life cycle of the systems for an additional five years. Commensurate with that additional five years increase in the life cycle, we also have an increase in the cost to $1.6 billion. However, I would submit that you have to recall there are operations and maintenance costs for that additional five years, so I won't look at that as cost growth, but a redefinition of our life cycle.

Mr. Young. You think everything is going to work out okay?

Ms. Kendall. I certainly do. I cite it as a model system in the Department.

Mr. Young. We are told that it is a model system and that is why we are curious. If it is that good we might want to apply it to some other things that we do around here.

Ms. Kendall. The Composite Health Care System is designed from the outset with defensewide requirements, consistent with our Corporate Information Management initiative.

Mr. Young. This Committee originally denied, but ultimately agreed to restore funding in conference for an Army unique tactical medical ADP system called TAMMIS. We are somewhat concerned that the Services continue to build their own unique medical ADP systems. What is the status of the congressionally directed architecture or strategic plan for Department of Defense ADP medical systems?

Ms. Kendall. We are planning to convene a Corporate Information Management functional group on the functional area of medical. That group will probably be convened at the end of April, early May. One of the important aspects we want that group to look at is to address the committee's request for an architecture and strategic plan. The DASD for Health Management Systems has developed a draft. We will be convening the CIM functional group to pull members from across the Department and one of their goals will be to look at that, make revisions, and ultimately produce that document, and we will be, after coordination, submitting it to the Committee.

[Additional information follows:]

The medical functional group has been established under the Department's Corporate Information Management initiative. This group will address the question of a strategic plan for medical systems during the course of its efforts. However, since the group has just begun, its specific work plan has yet to be determined. As the group moves forward on this task, it will consider on-going efforts, such as TAMMIS, for adoption as baseline systems for joint use.

Mr. YOUNG. One of the directions that the committee gave was that CHCS be centrally funded at the OSD level to prevent the Services from bailing out of the $1.6 billion program. Has this directive been complied with?

Ms. KENDALL. At this time centralized funding has been retained through fiscal year 1991, which is actually one year beyond our Milestone III, or our decision point for deployment. Partial decentralization is in fiscal year 1992. However, we do continue centralized control for our overall system management functions, which include configuration control, software, maintenance and testing.

There are some indications within the Department that we may be reassessing our approach in this funding.

Mr. YOUNG. Can you give us for the record a 1991 Service funding breakout?

Ms. KENDALL. I certainly will.

[The information follows:]

Funding for the Composite Health Care System by each of the Military Services in FY 1991 is as follows:

Army.—$2.3 million, for training, support for CHCS System Managers at various Army sites, and related implementation costs to include TDY (travel and per diem).

Navy.—The Navy does not contribute to CHCS costs until FY 1992, so the Navy has no funds budgeted for CHCS in FY 1991.

Air Force.—$6.7 million procurement investment, which covers 123 Air Force hospitals and medical facilities, including the Brooke Army Medical Center.

Mr. YOUNG. I have some questions dealing with the Defense Logistics Agency. Would you respond to those questions for the record?

Ms. KENDALL. Certainly.

[CLERK'S NOTE.—Questions submitted by Mr. Young and the answers thereto follow:]

DEFENSE LOGISTICS AGENCY

Question. The Committee has requested for over five years that the Defense Logistics Agency develop an integrated strategy for its logistics ADP modernization programs, which at one time were estimated to cost about $2 billion. Each year since, DLA has been unable to accomplish this objective and in response the Committee has implemented drastic funding reductions. Miss Kendall, has your offices approved a strategy for the DLA ADP modernization program as an integrated initiative?

Answer. An approach has been developed which will provide a workable structure to ensure DLA's modernization efforts can move ahead rapidly, with appropriate OSD and DLA oversight. DLA was advised of this approach September 26, 1989. It consists of:

Ensurance by DLA that all modernization efforts are managed consistently with policies for Life Cycle Management of Automated Infomation Systems.

Continued review by OSD MAISRC of those individual programs breaking the dollar threshold.

Conducting semiannual In-Process Reviews by the OSD MAISRC for all DLA AIS efforts to assess the projects and objectives in the context of the planning approach.

Ensurance by DLA that program costs include all O&M funds and those costs associated with the efforts of the Central Deisgn Activity. Resources must be traceable to the Budget Submission, Exhibit 43.

Implementation of the DLA AIS Review Council (DAISRC), which will review all DLA AIS efforts.

Question. What is the current "life cycle" cost estimate of the aggregate of all DLA ADP modernizations currently underway or funded in the five year defense plan?

Answer. The aggregate of all DLA ADP modernizations includes both major and nonmajor AIS programs. Life cycle cost estimates are available for DLA's major AIS programs. Life cycle cost estimates will be prepared for smaller AIS programs as they proceed through life cycle phases.

Life cycle cost estimates for DLA's major AIS programs, as reported in the most recent quarterly program progress reports, are as follows:

Life Cycle Costs

	Millions
Major AIS Program:	
Defense logistics services center (DLSC) modernization	$370.9
Defense automated addressing system ADP replacement program (DAAS DARP)	153.1
Standard automated material management system immediate improvement initiative (SAMMS 13)	976.5
Total life cycle costs for DLA major AIS programs	1,500.5

Question. For the record, break out in detail how 1991 DLA ADP modernization funds are planned to be utilized.

Answer. The FY 1991 funds required for DLA ADP modernization are the sum of all capital investments, commercial services for systems analysis, programming, design, and engineering, and studies and other (DLA Exhibit 43A, lines 1A–C, 4E–F). This totals $122 million in the President's Budget. Details by project are as follows:

[In million of dollars]

Project	P,DA	O&M
DAASO ADPE replacement program	10.3	2.4
DAISY	1.1	2.2
DLSC modernization program		13.8
FED LOG		1.0

[In million of dollars]

Project	P,DA	O&M
DISMS		
Pre-award/award/bid evaluation		1.2
DSR-Pacific		.2
Distribution/billing/stock fund		1.5
DWASP		
LOGMARS		1.8
Issues and transportation	5.6	
Enhanced depot distribution system	2.0	
MOCAS		1.8
SAMMS		
I3 platform	14.0	20.4
AIMS		.6
DPACS		5.9
SPEDE		.1
CTOL	6.5	1.0
MPCASS		.1
EDMICS	13.3	2.2
Other		
EDI	6.2	
Site obsolescence	.6	
Site telecommunications	6.0	

Also, $15.5 million in P,DA for MOCAS were reported as operations costs in the President's Budget. After the submission, DLA determined these P,DA funds should more appropriately be reported as modernization costs.

Question. The 1991 budget requests $116 million to buy computer equipment, up 231 percent from the $35 million appropriated in 1990. Why is it prudent for the Committee to approve such a large increase in the absence of a coordinated strategy approved by your office?

Answer. The approach spelled out in the DoD Comptroller memorandum of September 26, 1989 provides for DLA ADP modernization in a practical and modular fashion. The approach calls for the DoD MAISRC to perform In-Process Reviews semiannually for all DLA AIS's in addition to the major milestone reviews already required for major AIS's. These reviews will cover the concepts and strategies for AIS investments within the overall context of DLA modernization.

As described previously, DLA does have a coordinated strategy to execute its integrated modernization initiative in a logical and prioritized fashion based on mission criticalness and economic and qualitative benefits to the government.

Three major factors drive the large dollar increases for equipment purchases from the FY 1990 level of $35 million to the FY 1991 level of $116 million. The 3 factors are 1) implementation of Defense Management Report initiatives, 2) delayed requirements due to FY 90 budget reduction and 3) planned and budgeted equipment purchases for major automated information systems.

The establishment of several new initiatives required by OSD resulted in the infusion of funds in the FY 1991 budget request. These initiatives included the consolidation of military contract management functions under DLA, several Military Service EDI

Projects, and the formation of a consolidated Defense Messaging System. The formation of a consolidated Defense Contract Management Command (DCMC) necessitates migrating the Acquisition Management Information System, an Air Force System, to the DLA Mechanization of Contract Administration Services (MOCAS) system. In addition, DCASR data bases will be consolidated to accommodate the district realignments necessary for the establishment of the DCMC. To effectively support this mission, investment in a mainframe computer system and peripherals (robotic tape system, Direct Assess Storage Devices and printers) will be required. The DCMC program is estimated to result in savings over a 5 year period of over $200 million. The Military Service EDI Projects requiring funding include extensive EDI Projects at the U.S. Army Finance and Accounting Center. The Defense Messaging System Project requirement represents the initial investments for DLA's role in replacement/upgrade or automated message handling systems throughout the agency.

The FY 1991 requested figure reflects the result of the reductions taken from the budget in FY 1990. In late December 1989, Congress reduced DLA's ADPE/T budget for FY 1990 by $40 million, which forced a delay of all nonmission-essential small ADP/T equipment purchase.

In FY 1991 there are large scale equipment requirements to continue implementation of the DLA's MAISRC-approved programs—the Defense Automatic Addressing Office ADPE Replacement Program, the DLSC Modernization Program, and the SAMMS Immediate Improvement Initiative. There are also substantial equipment investments for DLA's participation in the Navy's MAISRC-approved program Engineering Data Management Information Control System (EDMICS) and for DLA's Warehousing and Distribution Systems (DWASP and EDDS). The FY 1991 Equipment Costs for these programs, as reflected in the January 1990 budget submit, are presented below:

	Millions
DAASO ADPE replacement	$9.863
DLSC modernization	.270
SAMMS 13 platform (mainframe host computers)	14.000
Equipment for other SAMMS 13 projects (CTOL, DPACS, AIMS, Post Award, SPEDE)	20.199
EDMICS	13.275
DWASP	7.628

The investment in these programs is critical to DLA's mission to provide timely and comprehensive logistics and technical support and high quality materiel to the military services at the lowest possible cost.

The MAISRC approved DAASO ADPE investment replaces obsolete 1960's vintage CDC computer platforms and software that are costly and difficult to maintain with modern computer platforms and data base management systems. By delaying the investment for this project OSD runs a high risk of mission failure in routing of logistics transactions for military and other customers. Besides being inflexible and unresponsive to customers needs some of the system software used in the existing DAAS is no longer supported by the vendor. Also, hardware parts frequently must be "reverse" engineered at a significantly higher cost than the original parts. Benefits of this program to the government are estimated at $351 million in discounted 1988 dollars.

The DLSC Modernization ADPE investment, also approved by a MAISRC, provides a modernized hardware and software platform to support the Federal Catalog System (which is mandated by Public Law 436) and the Military Engineering Data Asset Locator System. This mission requires an efficient, flexible and responsive hardware and software environment to meet the needs of the Federal Logistics community. The current CPUs at DLSC are fast reaching maximum workload capacity. These CPU's are being replaced in the DLSC Modernization Program in a phased manner beginning in FY 1990. In FY 1991 further hardware investments are required in the form of appoximately 99 on-site personal computers which can be linked to the new mainframes to provide access to the system under development. These PCs will also be used for stand-alone processing and data analysis. Without these PCs, DLSC personnel who need on-line access to the modernized DIDS and MEDALS systems will not have such access. Also, a paperless work environment will not be achieved. Benefits of the DLSC Modernization Program to the government are estimated at $109 million in discounted 1987 dollars.

The MAISRC approved SAMMS I3 computer and software platform and ADP equipment for other SAMMS I3 projects are necessary to support DLS's Integrated Material Management mission which provides worldwide supply support to the military services. Without the investment in initial mainframes and system software in FY 1991, there will be insufficient capacity at the supply centers to support the redesign of the Requirements and Distribution portions of SAMMS. The redesign is essential to alleviate IMM problems associated with inventory inaccuracy and inapplicable inventory growth. Laser printers, personal computers, communications and other ADP components are required in FY 1991 for other parts of SAMMS I3 such as the Pre-Award Contract Administration function (DPACS), cataloging functions (CTOL), and item management/recommended buy decisions (AIMS) functions to deploy these functions to the DLA supply centers. Overall, the SAMMS I3 program improvements will reduce the required inventory investment by over $100 million, reduce inventory errors by $45 million per year, greatly enhance and streamline cataloging and pre-award contracting functions, and increase productivity by over 800 workyears. Benefits of the SAMMS I3 Program to the government are estimated at $707 million in discounted 1988 dollars.

The (Navy MAISRC approved) EDMICS ADPE investment provides for the deployment of CPUs, optical storage devices and peripherals to implement the improved system for the management of technical data mandated by Public Law 98-525 at the first two DLA technical data repositories (DCSC and DESC). These systems will provide DLA with more accurate and timely data for decisionmaking relative to technical specifications and procurements. Without these systems, full information to support procurement competition will not be achieved and the cost of technical items acquired by the military services will continue to increase. Benefits are estimated at $362 million in discounted 1987 dollars.

In DLA's Warehousing and Distribution mission, major ADPE and telecommunications equipment investments are required to implement DWASP modernization increments 3 (Issues and Transportation) and 6 (Enhanced DLA Distribution System (EDDS)) at the DLA depots. The Issues and Transportation project requires that bundled Mobile Communication Devices, Communication Interfaces and Mobile Communication Base Stations be acquired, configured and installed at the depots. The equipment is necessary to provide the type of radio-frequency real-time/on-line connectivity to the DWASP host computer required to implement a paperless warehouse and provide control and visibility over materiel issues and transportation. The EDDS requires bundled system equipment including CRTs, printers, scanners and communications interface devices to provide DLA with the capability to consolidate multiple small carton Materiel Release Order shipments and less-than-truckload (LTL) freight to a specific area into truckload freight shipments with lower associated transportation costs. The equipment being acquired for EDDS will facilitate the required on-line/real-time interface with DWASP for the passing of data between the freight terminals and the DWASP mainframe computer, and the printing of required transportation documents (Government Bills of Lading, Military Shipping Labels, small parcel manifests and bar coded Operational Control Numbers) in the freight terminals. Finally, a replacement of existing dot matrix printers is required in the depot bulk warehouses. The existing printers produce marginal quality bar-code severely degrading the quality of service DLA provides to its customers. Benefits are estimated to be $90.6 million through FY 1995.

[CLERK'S NOTE.—End of questions submitted by Mr. Young.]

Mr. YOUNG. Thank you very much.

Thank you, Mr. Chairman.

Mr. MURTHA. Ms. Kendall, we appreciate your testimony. You can see the importance we place on this. Even though the House is adjourned, we have Members who have stayed here because they think it is so important. I just got a call from another Member who couldn't believe we were having a hearing today. This is something we are vitally interested in and we appreciate the work that you have done in that regard. We will have other questions for the record. Thank you.

The Committee is adjourned.

[CLERK'S NOTE.—Questions submitted for the record and the answers thereto follow:]

OSD OVERSIGHT

Question. We understand there have been some changes since last year within OSD concerning oversight of ADP systems. Please discuss and explain these.

Answer. We have taken several actions to strengthen oversight of DoD's Automated Information System (AIS) programs. Among these is the issuance of an updated and strengthened instruction on the review and milestone approval of all major and non-major DoD AIS programs including telecommunications and mission critical applications. This instruction defines the Major Automated Information System Review Committee (vice Council) (MAISRC) which is now a committee of the Defense Acquisition Board, and the role and responsibilities of MAISRC officials. The Comptroller continues to chair the MAISRC. We also have issued, for the first time, a manual to implement uniform procedures for the conduct of AIS Life Cycle Management (LCM) activities and to provide guidelines for the preparation and submission of documentation for LCM reviews.

CORPORATE INFORMATION MANAGEMENT

Question. How much is requested in FY 1991 as the "up-front" investment in this initiative, and how will these funds be used?

How long will it be until we see real results?

Answer. CIM budget for FY 1991 is $100 million for developing DoD standard information systems, allocated as follows: $50 million for procurement of hardware and software; $50 million for planning, analysis, design, development and engineering.

Initial savings are anticipated as early as FY 1991 in some functional areas which have a strong candidate for adoption or adaptation as the single DoD standard information system to support the function. No decisions have yet been made about specific functional areas and systems. The Defense Management Report estimated $288 million gross savings from $100 million investment ($188 million net savings) in FY 1991.

Thus far, results are already being seen. A number of early products have been produced by the CIM functional groups, such as agreement on the mission, scope, guiding principles, and vision of the future. Most notable is that parochial interests in the groups have evolved to Defense-wide interests.

The amount of time required for planning will vary by functional area, because the scope and complexity of the functional areas and the maturities of existing information systems supporting the functional areas differ substantially. A functional group with a narrowly-defined functional scope may complete its work in a matter of months, while a functional group with a broader scope will take longer. An initial estimate is that these functional requirements will take 9–18 months to complete. Participants of the functional groups work full time and are assigned to CIM for the duration of the project.

Question. What savings are assumed in FY 1991 resulting from this initiative? In the next 5 years?

Answer. Defense Management Report (DMR) estimated $288 million gross savings from $100 million investment ($188 million net savings) in FY 1991 for development of DoD standard information systems.

Overall, DMR estimated $3,471 million gross savings from $1,293 million investment ($2,178 million net savings) in FY 1991–1995.

Question. Explain your mechanism—the use of DOD "working groups"—to make this happen. How many working groups are there, and who are the members?

Answer. Each group will analyze the functional (business) requirements and information support requirements in their DoD functional area. A total of eight functional groups have been identified at this stage. The two pilot groups—distribution centers (warehousing) and civilian payroll—were considered highly successful and additional groups are, or soon will be, operational and will include civilian personnel, financial operations, government furnished material, materiel management, contract payment, and medical systems. Additional groups will be identified.

The functional (business) area groups include policy experts, subject matter specialists, functional operation specialists, and information system specialists from OSD, Services, and Defense Agencies. These participants are assigned to do this task on a full-time basis for the duration of the effort. Each group contains 20 to 35 full-time members detailed from across DoD. Each group is led by an OSD functional expert.

All functional groups will be using the same consistent methodology to develop a future-driven set of standard and functional requirements for their business areas. The methodology spans the broad definition of mission and scope of the functional area to the development of specific functional requirements. The methodology can be viewed as having three phases: future vision, future business plan, and information systems strategy.

Question. Describe the role to be taken by OSD offices.

Answer. Leaders of the functional groups are chosen from among the senior managers in the OSD office which has overall functional management cognizance of the function to which the CIM planning process is applied. Members of the functional groups are nominated by the Services and Defense Agencies and approved jointly by the leader of the functional group and by the Director for Corporate Information Management within the Office of the Deputy Comptroller (Information Resources Management).

Functional Steering Groups are being established to oversee the functional groups and ensure appropriate liaison with related ongoing DOD activities. The steering groups will be chaired by the senior official in the OSD which has functional management cognizance of the functional area. The steering groups will be comprised of the senior officials from the Military Services and Defense Agencies, the Senior IRM official, the Deputy Comptroller (IRM), the Director for Corporate Information Management, and other OSD officials with responsibilities related to the functional area for which the steering group is established.

The Office of the Deputy Comptroller (Information Resources Management) provides oversight and support of the Corporate Information Management Directorate and chairs the CIM Council, which was established to facilitate organization and staffing of the functional groups and overall implementation of the CIM planning process. The Director for CIM is responsible for setting up, managing, guiding, and coordinating the activities of the functional groups, and serves as the Executive Secretary of the CIM Council. The CIM Council includes representatives of OSD offices responsible for managing the functions to which the CIM planning process is being applied.

Question. How will you ensure that only mission-essential systems are built, rather than "cadillac" systems?

Answer. A key step in the CIM process is the prioritization of functional requirements identified in the Functional Business Plan.

This prioritization will be reflected in the overall implementation strategy (program concept), which provides the basis for reviewing plans and information technology budget exhibits for compliance with Corporate Information Management guidance. These reviews will be conducted as a routine part of the budget formulation process.

The implementation strategy (program concept) also provides the basis for reviewing AIS documentation at Life Cycle Management milestones for compliance with Corporate Information Management guidance. These reviews provide assurance that only the most effective, efficient, and economical systems will be developed and implemented as DoD standard systems.

BUDGET GROWTH

Question. A year ago, the Congress reduced DOD's fiscal year 1990 ADP budget request for $8.7 billion by $.6 billion. The new budget requests $9.5 billion, an increase of $1.4 billion (17 percent) from last year's appropriation.

Miss Kendall, what is causing DOD to request such enormous ADP budget growth this year?

Answer. The FY 1990 ADP reductions were applied in compliance with congressional intent. However, the FY 1990 ADP budget, as shown in the FY 1991 President's Budget submission, was adjusted upward by $.612 billion to establish a correct ADP program base in the Operation and Maintenance (O&M) appropriations. These adjustments related to fact-of-life changes (such as the higher 3.6 percent civilian pay raise authorized by Congress) and technical corrections to include funds budgeted for ADP but erroneously omitted from DoD's ADP budget documentation. Thus, the correct FY 1990 ADP program base is approximately $8.6 billion.

The budget request of $9.5 billion for FY 1991 is a 10.4 percent increase over the FY 1990 ADP program base. Of the increase, $363 million, or about 4.2 percent, is not attributable to growth in information technology systems, but is for fact-of-life changes, such as increases in civilian pay rates. Another 3.9 percent ($334 million) relates to the DoD Corporate Information Management initiative and is integral to supporting our Defense Management Report objectives. Only about 2.3 percent (about $200 million) of the increase is attributable to development and deployment of Component AIS's. This is not out of line with the overall trend within the Federal Government and reflects the increasing importance of Information Technology in performing the agency mission.

Question. The Congress "capped" DOD O&M funded ADP in 1990 at the appropriated amount, an increase to which required prior Congressional approval. We understand that as a result of implementing our cap, it was discovered that DOD's ADP budget to Congress has been annually understated by about $.8 million. Please explain this anomaly.

Answer. Although restrictive, the cap brought about a comprehensive review of the composition of the budget exhibits. That review indicated:

Inconsistent application as to what resources are covered by the definition of "automatic data processing equipment"; and

Confusion as to whether a particular resource was an "integral part of a weapon system."

We have corrected these areas. The Services and Defense Agencies have undergone an extensive review and data call to clarify and improve the quality and comprehensiveness of their 43-series budget exhibits. The budget exhibits now provide the Congress with a more comprehensive delineation of ADP resources.

Question. After correcting this error, DOD is still requesting about $900 million in growth in the fiscal year 1991 ADP budget. Please explain the main areas where you think growth is warranted, and why.

Provide for the record a concise summary of ADP budget growth in each Service and Defense Agency and its rationale.

Answer. The budget growth is attributable to three primary areas:

DOD Corporate Information Management Initiative.—$100 million: development of standard ADP systems; $154 million: CALS; $80 million: development and modification of accounting and information systems to track and account for stock funding of repairables. These initiatives are estimated to result in over $4.4 billion in savings through FY 1995.

Fact of life changes relating to price escalation and military and civilian pay raises ($363 million).

Continued development and deployment of a variety of major AISs.—For example:

Army—Reserve Component Automation System (RCAS). +$41 million for systems analysis and programming to support the competitive demonstration in FY 1991.

Strategic Logistics Program (SLP). +$12 million for systems analysis and programming for proof-of-principle demonstrations.

Navy—Naval Aviation Logistics Command Management Information System (NALCOMIS). +$9.5 million to acquire hardware and prepare sites to accelerate implementation of Phase II.

Inventory Control Points (ICP) Resolicitation. +$14.5 million to acquire CPU upgrades, additional storage, and peripherals to support full production of Phase II redesigned software.

Engineering Data Management Information and Control System (EDMICS). +$12 million to acquire hardware for naval aviation depots and shipyards.

Computer Aided Design (CAD) 2. +$7.5 million to acquire hardware from CAD 2 requirements contract.

DLA—Standard Automated Material Management System (SAMMS). +$53 million to acquire host systems for SAMMS Immediate Improvement Initiative (I^3) as well as enhancements (e.g., Cataloging Tools On-Line, EDMICS at DLA supply centers).

Question. Given the turbulence in the ADP area due to Secretary Cheney's management reforms and Secretary Atwood's management initiatives, why is any growth appropriate?

Answer. Improvements in technology and in the use of technology are key elements in maximizing the use of defense resources. We need to maintain our mission capability and one of the ways to accomplish this is through the application of information technology. A number of Defense Management Report initiatives rely heavily upon the use of information technology to obtain their associated savings.

Question. What would be the impact of holding DOD to a "no real growth" ADP budget in fiscal year 1991—in other words funding inflation and nothing else?

Answer. The Department is coping with major changes in its budget, and ADP is an integral and critical element in carrying out the changes being accomplished under the Defense Management Report and reaping their efficiencies and savings. ADP is essential to carrying out the Department's management programs.

As shown above, of the apparent ten percent increase in DoD's requested funding for ADP in FY 1991 over the FY 1990 corrected ADP program base, only 2.3 percent is for development and deployment of AIS's. About 3.9 percent is for Corporate Information Management. Both of these areas are aimed at improving DoD's operations and realizing long-term cost savings. The remainder of the increase is for fact-of-life cost increases. Thus, holding DoD to a "no real growth" ADP budget in fiscal year 1991 might jeopardize long-term economies to be realized through present AIS programs and the Corporate Information Management initiative.

COMPETITION PROBLEMS

Question. Allegations regarding improper bias in certain Navy ADP procurements were surfaced in 1988 when six ADP vendors complained to the Secretary of Defense about unfair practices that limited competition. Two recent GAO reports indicate that in the last 3½ years, 91 percent of Navy and 98 percent of Army mainframe computer and associated peripheral equipment acquisitions required "compatibility" with certain vendors products.

Miss Kendall, what do these statistics indicate to you, is there a lack of competition in DOD mainframe (large) computer acquisitions?

Answer. DoD has a constantly increasing rate of competition in its total ADP procurements over the past few years. Based on dollar value of procurements, the competition rate has grown from 51 percent in FY 1985 to 85 percent in FY 1989, an improvement of over 60 percent.

Question. In November, 1989 Navy Secretary Garrett testified to the House Government Operations Committee that "Our ADP assessment panel has found that specifications in certain of the procurements at issue were unduly restrictive in a manner which favored selection of IBM equipment . . . additional management attention is required . . .". What was the problem and how was it solved?

Answer. The problem was that requiring activities do not repeatedly procure ADP systems, especially mid- to large-size ADP systems, and, as a result, personnel developing an organization's ADP requirements package lack expertise needed to prepare quality specifications. The Navy has undertaken the following initiatives to correct this situation:

Providing activities and contracting officers with an independent technical specification review capability through the Federal Systems Integration and Management Center (FEDSIM).

Requiring Navy organizations to develop competition plans at the beginning of the procurement process, which are reviewed by activity Competition Advocates prior to release of solicitation documents.

Encouraging frequent use of draft request for proposals and specifications review conferences.

Improving dialogue with industry. Navy and Marine Corps activities have been directed to provide all vendors equal access to information concerning current needs and planned growth objectives.

Holding periodic high-level Navy/industry roundtables.

Centralizing the Agency Procurement Request (APR) process. APR's no longer flow directly from activity-level approval authorities to the General Services Administration (GSA). APR's are now screened by the Automatic Data Processing Selection Office or Headquarters Marine Corps prior to submission to GSA by the Director, Department of the Navy Information Resources Management.

Question. What actions have you taken to ensure that similar problems do not exist in the other Services or Defense Agencies?

Answer. Many of the problems that have been identified appear to stem from a lack of knowledge of proper procedures. We have taken actions aimed at improving awareness of requirements for competition through the Information Resources Management College (IRMC). Through the IRMC's "Paul Revere" project, over 1500 DoD personnel at 19 locations received training on the procedures and requirements for ADP acquisition. Also, the IRMC is developing short courses to include all areas of ADP management.

In addition, DoD is placing increased emphasis on Industry Processing Standards (IPS), which play an important role in AIS acquisitions. DoD's IPS activities emphasize AIS interoperability. Through the use of IPS, vendor proprietary barriers to an open systems architecture can be reduced substantially or eliminated. This should serve to reduce the number of compatibility-limited ADP procurements throughout the Department.

Question. Provide for the record competition statistics by Service and Defense Agency by year since 1985. Are things better or worse?

Answer. The following table shows percentage of completed purchases (based on percentage of purchase dollars awarded) of ADP by Service and aggregate Defense Agencies from FY 1985 to FY 1989:

Organization	Fiscal year—				
	1985	1986	1987	1988	1989
Army	45	71	79	79	93
Navy	57	71	76	78	86
Air Force	59	69	74	80	84
Defense agencies	41	46	47	72	79
DOD total	51	65	70	78	85

Based on the above statistics, the DoD has increased the dollars awarded by competitive contract from 51 percent in FY 1985 to 85 percent in FY 1989.

Procurements of office information systems are not included in the above statistics. The competition percentage rates for office information systems is even higher, reaching 97 percent in FY 1989 for all DoD.

CONSOLIDATION OF DOD ADP OPERATION CENTERS

Question. As part of Secretary Cheney's "Defense Management Review" initiatives, Secretary Atwood directed that a number of consolidation studies be made. One of them is aimed at consolidation of the Services ADP software design and computer operation centers.

Miss Kendall, please give us an idea of the number of activities involved:

What do these centers do?

How many are there?

How much do we annually spend on them?

How many of them are thought to be redundant?

Answer. These centers provide software development, software maintenance and data processing or computer operations support to all DOD users.

There are over 1700 Information Technology Facilities. The exact number will not be determined from the study results because of the exclusions made for various categories such as shipboard, mobile units, intelligence, etc. The study focuses on 660 candidate data processing insallation and all the major central design activites reported to the Congress in the information technology budget (exhibit 43E).

From initial study data, costs are estimated to be about $6.3 billion for data processing installations and central design activities annually.

None are thought to be redundant. We are attempting to identify efficiencies and economies that could be gained through consolidations which will save overhead costs and also permit increased utilization of excess capacity that may exist at some DPI facilities. Central design activities support existing application programs, and, as CIM initiatives move toward single corporate systems, single functional central design activities could be established with reductions in the other non-standard functional design centers.

Question. Discuss your ideas on how these could be consolidated. Would OSD force the Services to share computer facilities?

Answer. In its study of consolidation of ADP operation centers, the Department is examining all feasible options and challenging present methods of doing business in order to improve efficiency. We are seeking potential ways of reducing our ADP operations and overhead costs.

Many factors contribute to our belief that savings can be realized in our ADP operations. Recent advances in reliability and affordability of telecommunications allow the Department to consider realignment of ADP facilities. Networking may be the basis for sharing resources within and among ADP operations centers. Consolidations may occur, and these would be based on combinations of functional and geographic criteria, including the locations of existing facilities. We realize, however, that due to several factors such as need for investment costs and lack of industry open system standards, the consolidation efforts will be a long term effort.

Any consolidation would require careful planning to ensure no loss of mission support. Should the consolidation study identify savings based on the sharing of computer facilities among the services, then, yes, I would advocate that the Department move toward realizing those savings.

Question. When will the study results be given to Congress?

Answer. The study recommendations are being reviewed and will be forwarded to the Deputy Secretry midsummer 1990. I would expect that Congress would be informed shortly after a specific implementation alternative was approved.

Question. How much is included in your fiscal year 1991 budget as an estimate of savings resulting from this initiative?

Answer. The overall DOD Fiscal Year 1991 budget reflects a total of $300 million in savings for six Defense Management Report consolidation studies. Only one of the six consolidation studies addresses ADP Operations Centers. A portion of the $300 million savings will be applied to this area.

Question. A few years ago, the Committee directed that the many DOD telecommunications centers be collocated with DOD computer centers. This direction was largely ignored. Discuss how the proliferation of dedicated, unique telecommunications centers will be treated under this initiative.

Answer. The DOD Components did prepare consolidation and collection strategies and plans for Data Processing Installations (DPI's) and Telecommunications Centers (TCC's). The Services' plans were executed as funds became available, although the substantial one-time funding required to effect many of the consolidations did, in fact, not materialize as budget reductions were taken.

The Department is, however, taking actions, to include the Defense Message System effort, multilevel security network initiatives, and use of communications protocols, that will permit the eventual reduction of TCC's. The intent is to bring the organizational and individual message service directly to the user's desk via multifunctional terminal. thereby reducing the requirement for manpower-intensive TCC's as they now exist.

Question. What is the relationship between this initiative and your "Corporate Information Management" initiative previously discussed?

Answer. Both are part of the Defense Management Report initiatives. Corporate Information Management is addressing efficiencies and economies in the systems development arena. The initiative on potential consolidation of DOD ADP operations centers addresses the operations aspect.

The possibility of consolidating ADP operations and design center activities could complement Corporate Information Management. For example, consolidating design center activities along functional lines would consolidate Defense-wide expertise in functional areas and serve to support transition to the CIM standard information systems in each functional area. In addition, consolidated operation sites could provide operational support for these standard information systems.

PENTAGON AUTOMATION

Question. Three years ago we discovered that there was about $1 billion of computer upgrades going into the Pentagon alone. Miss Kendall, what is the current five year cost estimate?

Answer. The cost estimate for the five years FY 1990 to FY 1994 for Pentagon Automation in $910.6 million to support the Military Departments and the Office of the Secretary of Defense. This includes costs of operations as well as costs of development and modernization.

The total for Pentagon Automation is derived as follows ($ in millions):

Service/Agency	*Funding*
Army	95.2
Navy	108.4
Air Force	82.4
OJCS	189.3
OSD	435.3
Total	910.6

Question. What has OSD done to force the Services to coordinate their plans and to share equipment?

Answer. OSD has continued to encourage the Services to work with existing groups and support organizations, as a means of sharing ideas and experiences and for seeking resolutions to common problems. DOD Comptroller directed each Service to develop a coherent Headquarters Automation Plan and to establish a single responsible office and establish lead representatives for coordinating its headquarters automation efforts in order to reduce redundancy and promote compatibility of equipments. I have established a forum for these senior representatives to meet to review their requirements, share information, and promote the interoperability of their systems.

Question. If Secretary Atwood's "Corporate Information Management" initiative is to have true meaning, the best place to start is probably in the Pentagon itself. Wouldn't you agree?

How has the "Corporate Information Management" initiative affected Pentagon automation?

Answer. Pentagon automation is clearly a candidate functional area for Corporate Information Management review. While CIM is currently addressing several major functional areas within the Department, we eventually plan to address all functional areas. In the meantime, I have explicitly discussed CIM in our Pentagon Automation forum and encouraged application of CIM principles.

Question. Who in OSD is responsible for Pentagon Automation?

Answer. The DOD Comptroller has policy responsibility for all general purpose computing, including Pentagon Automation. Each Service has established an office of primary responsibility to coordinate planning and implementation of its Pentagon Automation program.

Question. Since we raised the topic three years ago, what has OSD done to improve the Pentagon Automation acquisition process?

What is being done differently today compared to the original plans three years ago?

Answer. DOD Comptroller has required each Headquarters Component to establish procedures for reviewing and prioritizing Headquarters automation requirements. When the Components briefed us on their Headquarters Automation Program in September 1989, each Component had complied with this requirement by establishing a mechanism to review and prioritize its automation needs. As a consequence there has been progress at individual headquarters levels. Our forum is an avenue for additional improvements across Service lines. If progress is insufficient, I will consider Pentagon Automation as a candidate for a CIM functional group.

COMPUTERS FOR THE ARMY RESERVES

Question. The Congress has been struggling with the Army and the Defense Department for 12 years to field a modern computer system for the Army Reserves. This system, called RCAS (Reserve Component Automation System), is essential to mobilize the Army during wartime. Recent world events make it even more critical today, as additional functions are transferred to the Reserves.

Miss Kendall, please describe the status of the Congressionally directed RCAS program.

Answer. Since Congressional direction has been given on this program, significant progress has been made.

During the past year Brig. General Carey and his staff have made tremendous progress in a number of areas. For example, the Functional Description, the Economic Analysis and the Test and Evaluation Master Plan, that laid the basis for MAISRC Milestone I approval in September 1989, were completed. The Request For Proposal was forwarded to industry with the responses due by the end of April 1990.

The Department still views this as a very challenging program and is committed to its success.

Question. Is the program fully funded in fiscal year 1991 and in the outyears?

Answer. RCAS is included in the Five Year Defense Plan through FY 1994, and the Army has fully funded the program.

Question. Congress gave this program directly to the Reserves for them to manage. Has this approach been successful?

Answer. Yes. The Reserve Component has been and continues to be successful in managing the RCAS. In addition to the Reserve Component being more familiar with Reserve Component functions, the Reserve Component has placed RCAS as their highest priority.

Question. What kind of support is being provided by your office to achieve the Congressionally directed goals of this program?

Answer. The program is formally reviewed semiannually by the OSD MAISRC and also at program milestones. We follow this up with submission of reports to Congress semiannually on program progress.

We continue to review quarterly program progress reports and supplement this with frequent informal contact with the Program Management Office to stay abreast of develoments as they occur.

Question. Since things seem to be going well for this program, what would be the impact of withdrawing the RCAS legislation at this time, requiring instead through report language that the current approach be maintained?

Answer. I believe that there would be no impact. The direction in the RCAS legislation has been followed and the program is proceeding on a timely basis. The role of the Chief of the National Guard Bureau and the acquisition strategy are firmly established. The program is well underway and we do not anticipate any changes in our direction regardless of whether the language stays in or not.

Question. Explain the apparent new start RECOMMIS ADP program to automate Navy Reserve functions. How much is budgeted in fiscal year 1991 for RECOMMIS by appropriation, what is the total life cycle cost estimate, and why can't a Corporate Information Management approach (using Army's RCAS) be used instead?

Answer. The Naval Reserve Command Management Information System is not a new start ADP program. RECOMMIS consists of several modules which were previously developed and are in various stages of deployment. These modules are: Reserve Station Training/Administrative/Readiness System (RSTARS); Headquarters Support (HQ SUPT); and Reserve Financial Management System (RESFMS).

The FY 1991 budget for this system is as follows:

Appropriation	*Thousands*
MPN	140
O&MN,R	14,255
OPN	2,618
Total	17,013

Total life cycle cost estimate is $89.2 million.

The Reserve Components functional area is one of the additional functional areas being reviewed for inclusion in the Corporate Information Management process.

LOGISTICS ADP

Question. In 1988 the Committee directed the Secretary of Defense to submit a "logistics ADP master plan" for the $6.5 billion of logistics computer upgrades then underway. The Committee has complained for years that the many expensive logistics computer system upgrades are uncoordinated and duplicative, to no avail. The recent "excess inventory" problem has made this even more urgent.

Miss Kendall, why has the Secretary of Defense not submitted a logistics ADP master plan as required by Congress?

Answer. A Logistics ADP Master Plan was provided the Committee on October 21, 1988. I would like to submit a copy of that plan for the record. The Department pointed out in its transmittal of the ADP Plan that work was underway on a Strategic Plan for Production and Logistics (P&L) which would incorporate the ADP Plan. Since that time, the P&L Strategic Plan was published in

May 1989 and submitted to the Committee. I would like to submit a copy of the P&L Strategic Plan for the record.

In addition to the logistics ADP Master Plan and the P&L Strategic Plan, the Department has made additional progress in addressing other areas of concerns outlined in the FY 1988 HAC Report. The report stated that the Army and DLA did not have strategic business plans for ADP modernization. They now have these plans, which are linked to the P&L Strategic Plan. In addition we have changed the POM preparation instructions to insure that the Services and DLA link their ADP programs to and support the P&L Strategic Plan.

Since the Strategic Plan was published in May 1989, considerable changes have occurred both in the global military situation and in DoD management. The Corporate Information Management (CIM) initiative and extensive consolidation proposals that will affect DoD logistics organizations and operations have become major management thrusts. They will impact logistics ADP in major ways. OASD(P&L) is working hard on the implementation of these actions which will result in far less duplication and more rational development of logistics ADP systems.

[CLERK'S NOTE.—The Production and Logistics Strategic Plan was provided for the Committee's files. The Logistics ADP Master Plan follows. A memorandum from the Office of the Secretary of Defense to the Committee on this subject dated September 29, 1989 contains the sentence: "As I stated in my letter transmitting the documentation directed by the House Appropriations Committee Report 100-410, that package was not the Department's definitive logistics ADP Master Plan, but a response to the Committee's concerns." The Committee therefore continues to believe that DoD has not complied with our requirement.]

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LOGISTICS

ADP MASTER PLAN

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I. INTRODUCTION

A. HAC Report Requirement

The House Appropriations Committee (HAC) in its report of October 28, 1987 (HAC Report 100–410) expressed a number of concerns regarding management of the Department's logistics automated data processing (ADP) applications. The Committee cited deficiencies in the Department's functional management of logistics ADP modernization and directed the Department to provide a logistics ADP master plan demonstrating that the necessary organizations, policies and programs are in place to oversee and manage the Department's logistics ADP systems. The Committee also questioned the role of the Computer–aided Acquisition and Logistic Support (CALS) Program in the Department's ADP planning and directed that there be an analysis documenting specifically how and when objectives of CALS will be achieved.

B. Purpose

This report responds to the HAC and describes the organizations, policies and programs in place and under development to manage the Department's logistics ADP systems; and explains the relationship of the CALS program to the Department's overall management of logistics ADP. Under separate cover, dated July 31, 1988, a CALS report was furnished to the Committee. CALS is an important part of the overall master plan and key elements are described in this report.

C. Organization of the Report

Individual sections in this report cover the following:

- A profile of logistics functions and ADP support
- Assumptions / constraints that guide future planning
- Organizational responsibilities in OSD / logistics systems goals and programs
- Conclusions

The report concludes that:

- Production and Logistics manages a complex, integrated universe
- ADP is a fundamental P&L tool
- Continuing planning and management are needed
- Modernization is a necessity
- DOD has an effective program to modernize logistics ADP
- A measurement process is required
- P&L is exercising greater management attention over logistics ADP

D. Production and Logistics Planning

DoD Production and Logistics (P&L) functional requirements are being identified in a comprehensive P&L functional plan, which is called the "P&L Strategic Plan." This Strategic Plan, which will be published in January 1989, will contain separate sections on all P&L functional mission areas, including logistics, procurement, production support, environment, installations, and on the ADP systems required to support these mission areas. The Strategic Plan will focus management attention on all P&L areas and guide the development and management of the DOD logistics ADP systems essential to carrying the Department into the future. This ADP Master Plan will be updated and become an annex to the P&L Strategic Plan."

The Strategic Plan will use the Departmental Planning, Programming and Budgeting Systems (PPBS), Defense Acquisition Board (DAB), and Major Automated Information Systems Review Council (MAISRC) processes to control the type and size of logistics ADP systems. Continued emphasis will be placed on the Department's strategy to achieve the highest degree of interoperability and standardization among Component systems through standardized applications, advocacy of multivendor interoperability of software products and the use of centrally managed DOD–wide applications to the maximum degree possible.

II. P&L: A FUNCTIONAL AND ADP PROFILE

P&L activities (supply, maintenance, transportation, requirements planning, logistics, procurement, installations and production support) are the largest of DOD program areas, accounting for more than half of the Department's total budget. The P&L mission functions are both numerous and complex and the management problems in these areas have been challenging. These functions are crucial to the war fighting mission, world wide, under an entire range of possible contingencies. ADP systems have become invaluable tools to operate, improve and assure the preparedness of production and logistics activities.

The ADP systems themselves, however, have encountered many problems and have undergone significant scrutiny as their use and number have grown. Many of the logistics functional and ADP issues are similar. For instance, the ADP systems in support of logistics processes have aged and the supported logistics processes have become out–moded when compared to modern private business practices. Both the ADP systems and the logistics processes suffer from extensive lead–time problems in changing methodology or in applying corrective actions across the enormous DOD infrastructure.

To illustrate, shown below are some of the challenges facing P&L functional and supporting logistics ADP systems.

A. Functional Problems and Issues

- Improving reliability and maintainability in new weapons systems
- Improving requirements determination, provisioning, replenishment
- Managing Department inventories, minimizing losses, maximizing accountability
- Improving item visibility: in stock, in transit, across components
- Ensuring security: physical structure, data protection
- Replacing aging logistics infrastructure
- Modernizing aging ADP: hardware, software, and communications
- Generating connectivity and interoperability: within DOD, external to DOD
- Reducing lead times: procurement, production
- Addressing resource constraints: dollars, personnel, equipment
- Building and maintaining an adequate supplier base
- Satisfying surge and mobilization demands
- Solving long supply inventory, reutilization and disposal problems
- Solving environmental and hazardous material issues
- Defining precisely ADP system modernization requirements and priorities
- Eliminating paper intensive processes

B. ADP Problems and Issues

- Focusing ADP modernization efforts on the highest functional priorities
- Modernizing or replacing obsolescent in–place systems
- Acquiring new systems in a timely manner: lead times, regulations
- Refreshing systems as technology advances; inserting new technology
- Stemming proliferation of standards, products, requirements
- Keeping abreast of increased capabilities and sophistication of the ADP user
- Responding to order of magnitude advances in methodology and technology
- Improving the ADP workforce: quality, retention
- Assuring availability of data where and when needed

Extensive management efforts are ongoing to resolve these issues. Effective ADP support is essential in managing DOD's enormous logistics operations, and it accounts for a significant portion of the P&L budget when all elements of ADP systems are included. These elements include hardware and software costs, equipment maintenance, equipment leasing, and salaries.

A major portion of the total DOD ADP dollar is spent on current operational systems. For those areas of concern cited by the Committee (i.e., new major logistics ADP system starts and upgrades managed through the MAISRC), the dollar amount as a percentage of the overall P&L budget is relatively small but nevertheless provides crucial support. Importantly, logistics ADP systems expenditures made as a result of the MAISRC approval process provide great leverage to the Department in terms of the applications performed and services provided for the dollars invested. As budgets tighten, as demographics affect the skills available in the workforce, and as technology advances, the leverage from these MAISRC systems becomes even greater.

The Department spends a relatively low annual dollar amount on replacing current and acquiring new logistics ADP systems when compared to the total life cycle costs of all such systems upgraded and maintained over many years. Although the major logistics ADP systems in–place have total life cycle costs in the billions of dollars, the major MAISRC logistics ADP systems under development for the Military Services and DLA account for expenditures of only $378 and $392 million, respectively, for FY 1987 and FY 1988.

The Department receives massive benefits from P&L standardization of its logistics ADP systems and derives tremendous leverage from investing dollars in these ADP systems which assure that the P&L mission can be executed. These logistics ADP systems are sound investments, particularly when one compares investment cost with the return–on–investment contributions.

III. ASSUMPTIONS AND CONSTRAINTS

In developing a Logistics ADP Master Plan one must make assumptions about both the future in logistics and in ADP technology. A plan predicated on such assumptions permits the identification of the transition actions required.

Mission / Threat and Financing the Mission

The relationship between P&L logistics functions and the role of ADP in supporting these functions will become even more interdependent. As threats increase in complexity and come from a growing number of sources, responses to the threat along with the support provided through ADP systems must keep pace. And, DOD must rely increasingly on emerging technologies to perform its logistics mission.

Carrying out the logistics mission will continue to absorb a major portion of the available DOD budget. ADP systems support will continue to require an increasing percentage of that mission cost because the costs of software and labor continue to rise and ADP is used in more instances. In times of cyclical cutbacks in spending, however, the resources applied to ADP in support of logistics processses will not be curtailed as sharply as the number of people performing logistics and the amount for their respective salaries. ADP will be even more deeply imbedded in our basic business activities as it is used to offset labor costs and replace manual applications.

Other countries will catch up with and procure current capabilities of the major military and industrial powers. Enemy nations and terrorist factions will become better equipped technically, more highly trained and their weapons systems more numerous. Qualitative and quantitative increases in the threat posed by those nations and their fighting capabilities will be countered by still more sophisticated American weapons systems. We must look to increased flexibility and sophistication of logistics ADP support to accommodate the concomitant increase in the complexity of logistically supporting our weapon systems.

Demographics

There will be fewer people available for the Military Services and entry level DOD civilian jobs. There could, as a result, be a widening of educational levels between entry level and established employees. Fewer and fewer of the highly–educated, degreed personnel coming into the workforce today start at positions such as inventory item manager; they tend, rather, to enter into broader management and rotational positions. Such job enticements are offered to stem the declining numbers of top applicants and to encourage recruitment of talented personnel. Many of the jobs that the more highly–qualified individuals used to fill upon entering the workforce are now being filled by less–educated or marginally–trained personnel. This problem exists in both industry and Government. Due to the perception that industry pays more and offers more opportunities, the problem is more prevalent in the Government. The situation will continue for the foreseeable future.

As the pool of recruits and entry level personnel shrinks, there will be increased use of and reliance on ADP technologies like Expert Systems. The increase in numbers of and complexity of weapon systems will, in turn, give added urgency to the need for more user–independent and user–friendly support systems and strategies. For instance, diagnostics applications will be integrated into weapon systems during the design stage. It will continue to be essential to assess whether we are executing the logistics jobs most effectively. We cannot afford to simply mechanize current business practices or perform currently mechanized areas faster.

Technology

ADP applications will undergo order of magnitude changes technologically. Communications advances will accelerate the connecting of logistics systems within the Department and with industry, and will reduce the reliance on paper–intensive operations. Increased technical capabilities in software and operating systems standardization will facilitate decreased ADP costs and increased multiple applications of individual systems.

ADP Implications

The broad points drawn above have potentially significant implications for the P&L ADP environment, as follows:

- The effects of inexperience and unfamiliarity with language usage and operational terminology will be offset by the OSD–encouraged development and increased use of ADP in support of logistics systems such as: menu–driven information systems and automated tools; incorporation of Artificial Intelligence/Expert Systems applications in day–to–day processing; and increased use of off–the–shelf products and standardized applications.

- The "brain drain" to industry in the technical ADP/information systems areas will continue unless an "incentive–to–stay" program is designed and operated by the Office of Personnel Management or by the Agencies. This drain of established and potential talent will increase the average age of the management portion of the DoD workforce markedly, limiting innovation and improvements. Unless federal personnel practices rise to the challenge, there will be fewer competent, upcoming managers to maintain corporate memory and manage the Department. For example, the new Federal Employees Retirement System (FERS) permits experienced workers, formerly held captive by years of investment in a Federal career, to transport their benefits, experience and capabilities, into the higher–paying private sector.

- The costs of hardware will be lower than today but the costs of software development and support systems will rise. Overall ADP/information systems support costs will increase due to increased DOD use of sophisticated ADP and telecommunications linkages.

- ADP will be innovatively used to support logistics processes while: (a) offsetting the lack of required numbers of qualified workforce; (b) progressing toward a paperless environment; and (c) taking advantage of state–of–the–art information systems developments.

- Communications capabilities will become increasingly efficient and used more widely. Many different media such as voice, video and digital (text and graphics) will be integrated in transmission methodologies. With this, however, will come increasing complexity. Due to this complexity, the Department will require the use of fewer but more rigid standards than today.

- Advances in communications software and standardization of vendor application packages will lead to increased use of networking capabilities to benefit from the contents of multiple data bases. These developments will hasten interconnection of DOD applications, not only with each other, but with other Government agencies and commercial enterprises.

- DOD and the private sector will routinely communicate electronically, using prescribed standards. The number of situations in which the contractor retains the data in support of weapon systems and as a service to DOD will increase. DOD will thereby be relieved of much of the burden of creating, massaging, and maintaining logistics information.

- Telecommunication networking and interconnectivity will permit more automatic links between weapon systems computers and data bases and those used by the logisticians.

- Advances in ADP and information systems support will lead to increased access to logistics support data across Component lines.

- Rigorous pursuit by the Department of strategies such as Computer–aided Acquisition and Logistic Support (CALS) and Electronic Data Interchange (EDI) will accelerate the arrival of a national information infrastructure in which all parties to a particular industry, business or specific application will have the capability to connect electronically and exchange needed, agreed–upon information. This exchange may include capability in a number of possible forms to suit the participating parties needs, i.e., voice and picture, text and graphics, digital and analog and single or multiple sites.

We have highlighted the problems and issues with which we are dealing and portrayed our view of the future as it will affect the world of P&L logistics ADP. These factors bear directly upon the implementation measures and strategies discussed next.

IV. ADP LOGISTICS SYSTEMS GOALS

In combination, the problems and issues of the present, together with the challenges and opportunities for tomorrow, mandate the aggressive application of the appropriate ADP technologies to achieve the DOD production and logistics mission objectives.

DOD can enhance its logistics posture in a variety of ways; investing in additional wartime inventory, adding logistics force structure, modernizing its physical plant, improving its business methods, increasing productivity, and automating. There is not enough budget projected—or even imagined—that can finance all of the logistics improvement measures that DOD managers could employ. We must very judiciously select how to invest and use the resources we have. In short, we must find the highest leverage investment areas so that we get the most logistics improvement for dollars invested.

The need for such leverage drives us directly to automation, the digital exchange of information, and the full range of emerging information science technologies. We can no longer afford to simply increase the inventory investment; we must, instead, identify our needs more clearly and manage better what we already have. And we can do the latter with the effective use of modern, effective ADP support. Our logistics ADP goals are therefore to: (a) organize for effective ADP management; (b) use commercial / international standards as DOD standards if appropriate or develop and use DOD–wide and standards and systems; (c) develop and use broad systems–wide management tools; and (d) field modern, cost–effective ADP systems.

A. Organize for Effective ADP Management

OSD Management Structure

1. Office of the Assistant Secretary of Defense (Production and Logistics)

The ASD (P&L) is responsible for managing the P&L functional areas and for the ADP tools used to carry out the mission of these areas. In late 1987, in order to strengthen logistics ADP management, the ASD (P&L) consolidated under the DASD (Systems) the offices responsible for planning and implementing systems in support of that P&L mission. Of the six DASD (Systems) directorates, three are directly involved with ADP management within P&L. These three directorates are:

- the Production and Logistics Information Systems (P&LIS) Directorate;
- the Computer–aided Acquisition and Logistic Support (CALS) Directorate; and
- the Systems Plans Directorate.

Taken together, these three directorates provide an integrated approach to the desired future ADP environment.

The DASD (Systems) organization was established to ensure, among other missions, that P&L is engaged early in the ADP and information systems (IS) development and implementation process and that the cost effectiveness of P&L ADP systems is increased. The DASD (Systems) ADP mission is to: (a) perform overall long–range and transition planning for OASD (P&L)–related IS; (b) lead the modernization efforts for IS; (c) improve the speed and effectiveness with which quality IS are developed and implemented; (d) perform an integration function among Military Services and DLA to encourage joint development of systems; (e) introduce appropriate advanced technology and ideas into IS; (f) reduce duplication of effort among Services and DLA in the development of systems; and (g) develop and establish standards on a national and international basis for interchange of information within DOD, with industry, and with international organizations. The

Department's goal is to use commercial standards where fully applicable and to influence their joint development to the Department's advantage, in cooperation with industry, where commercial standards are not portable to DOD applications.

Within DASD (Systems), the Production and Logistics Information Systems (P&LIS) Directorate is responsible for assuring that the functional and technical requirements for IS are logically, effectively, and economically planned, designed, implemented and modernized. P&LIS has full responsibility, beginning with Concept Development, for the functional and technical aspects of P&L ADP systems applications requiring the approval of the MAISRC. P&LIS assists the Military Services and DLA to identify logistics information requirements and to obtain their technical systems support as quickly as possible. P&LIS has hardware, software and telecommunications expertise in–house and tracks the Department's functional use of ADP, and the current and emerging technical aspects of ADP and communications.

The CALS Directorate is responsible for: a) developing DOD CALS corporate planning, policy and priorities for CALS implementation; b) developing, testing and implementing technical data interchange standards and product definition; c) ensuring interoperability among the Components' technical data systems; d) sponsoring technology development for integration of technical data processes; and e) ensuring Government/Industry interface. In addition, a DOD CALS Steering Group has been established. It is chaired by the Deputy Assistant Secretary of Defense(Systems). This group includes senior representatives from each Military Department, the Defense Logistics Agency, the Defense Communications Agency and key OSD organizations. Their charter is to provide overall policy and executive direction for CALS programs within DOD.

The Planning Directorate is responsible for designing and developing the integrated, comprehensive, prioritized corporate P&L Strategic Plan to provide guidance to OSD P&L, the Military Services and DLA. The P&L Strategic Plan will integrate strategies from all of the P&L functional areas and will form the basis for further refinement of this ADP Master Plan.

2. The Comptroller of the Department of Defense

The Comptroller of the Department of Defense (Comptroller) has been designated as the Information Resources Management (IRM) official for the Department in accordance with DOD Directive 7740.1, "DOD Information Resources Management Program," June 20, 1983, which enacts Public Law 96–511, "The Paperwork Reduction Act of 1980," December 11, 1980. The Deputy Assistant Secretary of Defense (Information Resources Management) carries out these responsibilities. The Comptroller has responsibility for the issuance of the Department's official policy documenting the control and application of ADP to include the Directives that establish the methodology by which ADP applications are approved and maintained. Primary operative directives include DOD Directive 7920.1, "Life Cycle Management of Automated Information Systems," and DOD Instruction 7920.2, "Major Automated Information Systems Approval Process." The Comptroller oversees the costs and brings together and publishes overall information on the logistics ADP systems of the Department. The Comptroller also is Chairman of the MAISRC and provides Executive Secretary support.

3. Other Key Organizations

Three other key participants in the oversight and control of the Department's logistics ADP systems are the: (a) Assistant Secretary of Defense for Program Analysis and Evaluation (PA&E); (b) Assistant Secretary of Defense for Command, Control, Communication and Intelligence (C^3I); and (c) the Director, Operational Test and Evaluation (OT&E). These organizations' chief responsibilities are to ensure the ADP applications conform to official regulations in their respective areas. Their primarily responsibilities for ADP systems applications are respectively: verification of cost data and required analyses; attention to communications and security; and implementation / testing planning.

(a). Major Automated Informations Systems Review Council

The MAISRC is the DOD vehicle established to carry out the review and decision process described in DOD Instruction 7920.2, "Major Automated Information Systems Review Process." This Instruction supplements the provisions of DOD Directive 7920.1, "Life Cycle Management of Automated Information Systems." The MAISRC is composed of top level officials of OSD who review major ADP systems applications and approve or disapprove them at designated decision points during their life cycle. The MAISRC principals, or voting members, are: the Comptroller of the Department of Defense; the Assistant Secretary of Defense (Command, Control, Communications and Intelligence); the Assistant Secretary of Defense (Program Analysis and Evaluation); the Director, Operational Test and Evaluation; the respective, sponsoring Component's Assistant Secretary (ADP/IRM official); and the OSD system sponsor, e.g., the Assistant Secretary of Defense for Production and Logistics, in the case of P&L functional systems applications.

(b). Functional Management

Functional management in the area of logistics ADP systems is the responsibility of the individual DASDs within P&L. The Deputy Assistant Secretaries of Defense for Production Support; Procurement; and Logistics are the major participants. Within the Logistics Deputate the individual Directorates most concerned with and responsible for significant operational logistics ADP systems are: Supply Management Policy; Maintenance Policy; Logistics Planning and Analysis; and Transportation Policy. Within the Procurement Deputate, the Directorate of Contract Policy and Administration is responsible for oversight of operational procurement ADP systems. Within the Production Support Deputate, the Standardization and Data Management Directorate provides functional oversight management to the engineering data repository, technical manual and configuration management programs. These areas work closely with DASD (Systems) and Component organizations to ensure the functional requirements necessary for the success of their program areas are recognized and integrated into the early–on design and development of the ADP systems supporting their functional processes.

B. Develop and Use DOD–wide Standards and Systems

There are literally thousands of individual computer applications in the DOD logistics community serving a host of functions that involves millions of transactions. Opportunities to enhance the capability of the logistics systems in total through standardization and interoperability abound. Indeed, without some minimum level of interoperability, the overall logistics system itself breaks down. Moreover, the opportunity to leverage investments in ADP is enormous. This section describes some of the DOD–wide systems undergoing aggressive development and modernization and standards that will lead to a high leverage, less paper–intensive environment.

It must be realized that there are two categories of "systems" applications involved in this discussion. One use of the term system relates to actual processing systems. The other use of the term "system" refers to an organized and established set of initiatives or procedures employed to provide and facilitate interoperability among the first type of systems. Applications of the second type often use the word "systems" in their titles. For clarity, these applications are referred to as "standards" in this section.

The category of true processing systems includes systems such as a Component's inventory control point system or wholesale depot processing system. Using the Army as an example, these two systems are respectively, the Commodity Command Standard System (CCSS) and the Standard Depot System (SDS). Both of these are major Army logistics ADP systems, with life cycle costs of approximately $750 million, are comprised of millions of lines of computer code and are processed at multiple sites. The other major Components have applications similar in size, complexity and costs.

For a given Component, many of their actual processing systems are highly standardized and except for specialized sites, the application programs processed at different physical sites are identical and are maintained from a central point. Thus, the Army SDS applications are run at some 20 Army depots, and although not every single program application may be run at every site, those that are processed at any site are exactly identical to those run at the other sites.

The Department, in cooperation with the Components, has done a good job in employing systems standardization and eliminating duplication among physical operational sites for these large wholesale operations. This is less true on the retail side since investment in the wholesale applications offers the greatest leverage. However, as most wholesale processing systems have now been standardized at the Component level, attention is being given to the retail side and progress is being made toward retail systems standardization.

Across Component lines, however, the systems used to process similar logistics applications are different. Because of unique mission requirements and differing baseline systems architectures many of these do not lend themselves to inter–Component sharing of full and complete, identical systems or even major portions of the computer code comprising similar applications. Even though all Components cannot use the same system for a given application, one or more Components often do so where their operations are compatible.

The second category of standards, those that allow the first type to interconnect, is a set of agreed upon rules and conventions to allow interchange of data among different application processing systems.

For the true processing systems category, applications exist at both the Component level and at the Department–wide level. Only DOD–wide examples are discussed below. In the standards/interoperability category, all of the systems discussed below are Department–wide and are part of the effort to move to complete interoperability throughout the P&L universe. This includes dealing with the private sector.

While initiatives over the long term in standardizing architectures and sharing applications will eventually produce more commonality, the most significant near and mid term advantages can be attained by developing and using Department–wide standards and systems.

1. DOD–wide Standards

(a). Modernization of the Defense Logistics Standard Systems (MODELS)

The Defense Logistics Standard Systems (DLSS) are used throughout the Department by all Components. The DLSS framework sets standards for describing, communicating and processing data for the entire Department in logistics support. Each Component is required to follow the DLSS in transferring, massaging and utilizing logistics data in support of world–wide operations. DLSS, comprised of many distinct modular applications, are DOD–wide applications that relate to specific functional areas of logistics.

DLSS modules cover the functional areas of:

(1) requisitioning material;
(2) transporting material;
(3) accounting and reporting the status of material;
(4) billing for material;
(5) administering contracts;
(6) reporting discrepancies;
(7) evaluating performance of logistics activities; and
(8) communicating logistics information.

These applications were designed and have been maintained centrally and operated on a Department–wide basis for over 25 years. These systems have been modified centrally over the years to accommodate changing requirements.

The uniform policies, procedures, forms, reports, documents, data elements and time standards of the DLSS serve as essential procedural bridges between, among and within the management systems of the Defense logistics community. The functional manager for logistics at the OSD level recognized the requirement in 1985 for the total overhaul of the DLSS.

The evolution and use of DLSS by the Components, and many civilian agencies, have resulted in 25 years of computer software applications which are now present in our current logistics ADP applications. These applications represent differing capabilities as they are comprised of many different generations of application program development. Every time a change is made to basic operating methodology, all logistics organizations operating under DLSS conventions must make unique program code changes. MODELS is being designed to modernize and completely overhaul the DLSS and solve this problem. With implementation of MODELS, changes to the way all DLSS participants conduct logistics business will be possible without necessitating individual actions by all organizations using the DLSS conventions.

OSD oversight and management will assure that there will be DOD–wide integration through common standards and conventions and that the Department makes maximum use of off–the–shelf software and commercially–recognized standards.

The Chief, Defense Logistics Standard Systems Office, reporting to the Directorate of Supply Management Policy within the Office of the Deputy Assistant Secretary of Defense for Logistics, is the designated Project Manager for the implementation of MODELS. Substantial work has been completed and more is underway to accomplish implementation. Major project phases and status are presented below.

MAJOR PHASES of MODELS

PHASE	Start Date	Completion Date
Perform Mission Analysis	1 Aug 84	31 Mar 87
Develop Basic System Concept	1 Dec 85	30 Apr 87
Perform Project Definition	4 Jan 88	28 Feb 91
Perform Project Design	22 Jan 88	31 Dec 90
Perform Systems Development	30 Nov 90	15 May 92
Accomplish Systems Implementation	1 Dec 89	15 May 92

(b). Electronic Data Interchange (EDI)

EDI is the second of three DOD–wide initiatives in the move to a Department–wide paperless environment. OSD recognized that the Department needed an across–the–board, total interface with the commercial sector in everyday dealings for business transactions. These are business transactions external to DOD. It can be said that EDI is to external DOD business what the DLSS are to internal DOD business. Take, for example, how DLSS governs a requisition between a DOD requisitioning activity and an inventory control point (ICP), and possibly a depot. Except for shipping documentation required in normal American commerce, this process, from initial ordering to final delivery, is totally automatic and paperless. If, however, the requirement is to be satisfied outside of the DOD supply system, a hard–copy purchase order is produced to the commercial sector. The commercial sector sends a hard–copy invoice which is input into the Government's records manually, and the manual process continues through the billing cycle. Since there are routinely many follow–up inquiries and acknowledgements, the automation of this scenario contains tremendous potential for savings. EDI will replace cumbersome manual, hard–copy business transactions with electronic transactions.

EDI is a reality and is broadly used today in the commercial sector. Individual private business concerns are using EDI at an ever–increasing rate. The Department has called for the Components to adopt the American National Standards Institute (ANSI) X.12 standard, the standard of choice for most users, to hasten Department–wide EDI usage and facilitate exchange with major commercial users. Adoption of ANSI X.12 was an OASD (P&L) proposal which was fully staffed within OSD and approved by the Deputy Secretary of Defense on May 24, 1988. The P&L plan is to employ EDI for every feasible DOD logistics ADP application used outside of internal DOD business, without waiting for MODELS which is several years away. Those functions which are candidates for EDI now are invoices, purchase orders and amendments, bills of lading and similar business transactions. As part of the Department's plan, MODELS will require the same commercial conventions and standards as EDI; thus, applications utilizing EDI will require only minor modification later in order to use MODELS once it becomes operational. The initial EDI effort has commenced with the redesign of transportation applications.

Electronic Funds Transfer (EFT) is a subset of EDI and is included in the Department's planning. All planning for EDI/EFT includes use of commercial standards and DOD is actively involved in promulgating use of these standards. The requirement for MODELS to apply the same conventions and standards as EDI/EFT will allow direct transfer of external business transactions from DOD systems to the commercial sector once MODELS is in place. As in MODELS, great return–on–investment to the Department will result in the blanket use of EDI/EFT.

EDI MILESTONE EVENTS and DATES

EVENT		Action Date	
Issue Policy memorandum	Completed	May	1988
Obtain Interagency support	Completed	Jun	1988
Form OSD Coordination Group	Completed	Jul	1988
Form Joint Service/Agency Group	Completed	Sep	1988
Establish EDI Action Plan		Nov	1988
Program to develop and maintain standards		Nov	1988
Establish Industry Support Group		Jan	1989
Identify/evaluate/support/track EDI projects		Mar	1989
Develop an EDI Implementation Plan		Jun	1989

(c). Computer–aided Acquisition and Logistic Support (CALS)

CALS is the third DOD–wide initiative that is leading to improved acquisition and logistics processes. Through the automation and integration of technical information associated with the weapon systems design, manufacturing and logistic support processes, CALS implementation will transition from the current paper–intensive environment to the efficient access and exchange of digital information between government and industry. Like EDI, a major part of the CALS strategy is to develop digital interchange standards that will improve transfer of information from one organization to another. However, the CALS initiative is addressing technical data such as engineering drawings, bills of material, process specifications, and technical manuals, whereas EDI is associated with business transactional data. In addition, the primary focus is on information systems integration and the interchange of information between the government and industry in a heterogeneous computer equipment environment.

The long term objectives of CALS are to strengthen the industrial base and maintain U.S. competitiveness through increased productivity and quality of our weapon systems, components, support processes, and associated technical data used to manage acquisition and logistics. Substantial reduction in acquisition and support costs and leadtimes, as well as increases in weapon system and data quality, are expected as duplicative processes and information are eliminated through automation and integration. A joint DOD/Industry Steering Group is coordinating efforts to ensure effective implementation within both DOD and industry.

The key elements of the CALS program strategy are to:

- accelerate the development and testing of standards for digital technical data interchange and integrated database access,
- sponsor technology development and demonstrations for integration of technical data processes,
- implement CALS standards and integration requirements in weapon systems contracts and encourage industry modernization, and
- incorporate CALS standards and integration requirements into DOD systems infrastructure planning/architecture and modernization programs.

CALS is playing an important role in the modernization of logistics ADP systems, particularly those for which the primary purpose relates to generating, accessing, managing, maintaining and/or distributing technical data for use in acquisition and logistics processing. OSD is leading the Components in a planning effort to coordinate ongoing programs and to develop the technical information architecture that will support acquisition and logistics processes within DOD. CALS standards are being incorporated in systems that must interface within DOD, as well as those systems which receive input data from industry. Key areas include engineering data repositories, computer-aided design, and electronic technical manuals. CALS is also coordinating its efforts with supply, maintenance, and procurement system modernizations which require technical information. Technical standards are being developed to facilitate exchange of data in a digital environment. Individual CALS related ADP systems are being reviewed within the MAISRC and Component review processes.

CALS is being implemented in phases, as standards and technology are developed and inserted into DOD and industry information systems. The first set of CALS Phase I standards, for text and graphic interchange, were published in late 1987 to support routine delivery of digital data to DOD from weapon systems contractors in the early 1990s. These standards are being incrementally extended to a broader base of applications. Initial CALS Phase II standards for interactive access to fully integrated data bases will be published in the early 1990s to support routine implementations in the mid 1990s and beyond. The technology to support Phase II is being developed and demonstrated in research and development projects and lead weapon systems within each Service. These systems, and others, will serve as prototype implementations as CALS integration requirements and digital interchange standards are incorporated in weapon system contracts that will deliver data to DOD systems. Key milestones within the four CALS strategies include:

KEY CALS PROGRAM ELEMENTS / SCHEDULED EVENTS and MILESTONE DATES

ELEMENT	Start Date	Completion Date
Develop and Test Standards		
– Initial Publication	Completed	Dec 1987
– Annual Release of Follow–on Standards	Dec 1988	Dec 1990
– Testing	Dec 1987	Continuing
Develop and Demonstrate Technology		
–Technology R&D Projects	Mar 1987	Continuing
–Weapon System Demonstrations	Mar 1987	Continuing
Implement in Weapon System Contracts		
– Policy Issued	Completed	Aug 1988
– Implementation in Contracts	Oct 1988	Continuing
Incorporate into DOD Systems		
– Planning / Architecture	Sep 1987	Jun 1989
– Infrastructure Modernization	Sep 1987	Mar 1993

Additional details are provided in the CALS Report to the House of Representatives, Committee on Appropriations, dated July 31, 1988.

2. DOD–Wide Logistics ADP Processing Systems

(a). Modernization of the Defense Logistics Services Center System

The Defense Logistics Services Center (DLSC) System is the ADP center in Battle Creek, Michigan, in which the Federal Catalog System (FCS) is operated. The FCS is supported through the Defense Integrated Data Systems (DIDS), an international system that maintains and provides, to customers worldwide, characteristic and management data on items of supply and information on logistics operations and provides for control and assignment of a unique "stock number" to all items. This massive data system supports 6.2 million active items on file and processes millions of individual transactions per year. Some examples of specific support categories and annual volumes are: 22.4 million general and 138 million mass data queries processed; 24.9 million items screened; 7.2 million detail transactions processed; 231 thousand new items (stock numbers) assigned and placed in the system; and over 400 individual publications generated in hard copy and microfiche form.

DIDS ADP is nearing the saturation point and by 1989 its data base, software and hardware capabilities will reach their capacity to maintain the volume, kind and quality of service that are required. As more and more logistics applications have been automated and grown over the years, the solution has often been to add to current DIDS capacity with a minimal dollar investment "fix" instead of redesigning the DIDS in total. As a result, the DIDS performs its functions in the manner of past generations of equipment and application methodology.

Consequently, a management program was created to acquire systems that would meet projected requirements into the early 21st century, systems that will replace sequential files and processing with modern data base technology and outmoded batch processing with state–of–the–art, on–line transaction processing. This program was recently approved by the MAISRC for Milestone 2.

DLSC MILESTONE EVENTS and DATES

EVENT	Start Date	Completion Date
Acquisition Phase		
Prepare, Review, Revise RFP	Feb 1987	Sep 1988
Release RFP	Aug 1988	Sep 1988
Prepare Proposals	Oct 1989	Dec 1989
Select Source	Oct 1989	Sep 1989
Award Contract	Aug 1989	Sep 1989
Install Initial System	Oct 1990	Mar 1990
Development Phase		
Prepare Functional Description	Feb 1987	Mar 1988
Prepare Systems Specifications	Aug 1987	Mar 1991
Perform Programming Activities	Feb 1988	Sep 1991
Perform Testing Activities	Aug 1988	Dec 1992
Implement Complete System	Feb 1990	Jun 1992

(b). Modernization of the Defense Automatic Addressing System

The Defense Automatic Addressing System (DAAS) is a system used in conjunction with the DLSS to address, route and journalize the millions of P&L logistics transactions that are processed by the Components' logistics ADP functional application systems. DAAS, like the other DOD-wide systems discussed in this section, has remained essentially the same for a number of years; there have been only occasional, partial upgrades to add capability and to speed cyclical processing as the number of DOD transactions has increased and more logistics functions have been automated.

DAAS is to undergo major modernization of both hardware and software applications. The hardware is currently being upgraded to allow DAAS to keep up with logistics systems growth and to carry out its functions during the transition from complete reliance on the DOD Automatic Digital Information Network (Autodin) message switching system to the Defense Data Network (DDN). This upgrade is the DARP (DAAS ADP Replacement Program). The software changes are to come later as MODELS is implemented. MODELS design provides for the direct transfer of logistics transactions between major logistics processing sites (nodes) such as a requisitioning site and an inventory control point or a depot. This design is an improvement over routing all transactions over one of two fixed DAAS sites since every transaction must currently be handled at least twice. When MODELS is implemented, transactions will be passed directly between the appropriate nodal sites. As a result, duplicate processing will be reduced, physical security will be augmented and the risk of a major ADP problem affecting the entire system will be reduced.

Modernization of DAAS software applications will entail a revised role for DAAS under MODELS in the administration of the MODELS processing software and the management, scheduling and implementation of program changes. Key DAAS nodal sites will still be required and the journal keeping function will remain. The added modern hardware will have some life remaining when MODELS is implemented and will be used by DAAS in its future role. The DARP is undergoing MAISRC review. Event milestones and dates are shown below.

DARP MILESTONE EVENTS and DATES

EVENT	Start Date	Completion Date
Submit as Critical Baseline Enhancement	FEB 1987	FEB 1987
Determine MAISRC Program Level	OCT 1987	OCT 1987
Prepare Systems Decision Paper	AUG 1988	AUG 1988
Hold Milestone 2 MAISRC Review	2QTR FY89	2QTR FY89
Issue RFP	3QTR FY89	3QTR FY89
Implement Hardware Modernization	3QTR FY89	1QTR FY90

C. Develop and Use Broad Systems-wide Management Tools

Careful system by system reviews, along the lines mentioned above, are vitally important. However, these reviews must be made within a broad functional and systems management context. To this end, several major efforts are underway within the DASD (Systems) organization that will provide a better understanding of the entire picture of logistics ADP systems support.

1. Functional Diagrams

The DASD (Systems) organization has completed and documented logistics processes and supporting ADP systems in each Component in the form of functional diagrams or "wall maps." This documentation has been completed for "as is" and "planned" applications. Each depict general logistics processes in terms of the logistics ADP systems applications supporting them. These functional diagrams are valuable tools to plan for and manage DOD-wide integration of applications and consolidation of functions where feasible. The DASD (Systems) has also developed similar functional diagram documentation for significant DOD-wide systems development applications such as MODELS and CALS. These diagrams include both new and enhancement modernization efforts.

In addition to the functional diagrams, which provide a brief overview of key logistics and supporting ADP systems, a baseline of the architecture, functions and technical applications is being documented. This architecture, described in the next paragraph, includes actual hardware employed and the specific configurations used.

2. Architecture

A major initiative of ODASD(Systems) is to identify the current and future functional and technical "architecture" of all P&L information systems. In this context, the functional architecture will address the global processes, procedures and information flows used by the P&L community to perform its mission. The technical architecture will delineate the technical "building blocks" such as the applications systems, data bases, hardware, and networks to support the functional architecture.

One must exercise care here in understanding our use of the word "architecture" and interpreting its meaning. The word "architecture," when used in relation to computers, is often interpreted as meaning the physical configuration of computer hardware, the physical construction and arithmetic processes employed. This definition goes back to very early usage of the word in the computer industry. It is still a valid usage. For our purposes however, "architecture," as it relates to functional aspects of logistics ADP systems, is taken from its much older origins, that of the architect as planner. It is used to cover the unified overall design, form and structure of the P&L information systems. As used in relation to the technical aspects of logistics ADP systems, the word "architecture" is closer to its conventional involvement with "construction" but is still used to encompass those technical areas that support the logistics functions.

Once these functional and technical architectures are documented, systems deficiencies are identified and future requirements are developed, an effective oversight program will be developed. Establishing these current and target baselines is critical to information systems long range planning, policy development, major systems review and standardization.

The current and future functional architectures are being developed in consonance with the functional proponents. After the current functional architecture is defined, processes, procedures and information flows will be mapped to current technical automated information systems. Deficiencies and problems will surface and will be identified for correction in the future technical architecture. At this point in the process the future requirements will be married with known deficiencies. This will provide the technical requirements for the future architecture.

The new architecture will address standards required, new systems, insertion of technology and the building blocks required to meet the requirements of the future functional architecture. These architectures will then become an integral part of the P&L planning process. They will also provide a knowledge base to use during major systems reviews to insure that the systems are meeting interface requirements, standardization and interoperability needs, and achieve long term integration goals. The milestone events and dates for this initiative are shown below.

DASD(S) ARCHITECTURE INITIATIVE – MILESTONE EVENTS / DATES

EVENT			Start Date	Completion Date
Determine Current Architecture				
	Functional	– DLA	Oct 1987	Sep 1988
		– Army	May 1988	Jan 1989
		– Navy	TBD	Jan 1990
		– Air Force	TBD	Jan 1990
	Technical	– DLA	Oct 1987	Sep 1988
		– Army	May 1988	Jan 1989
		– Navy	TBD	Jan 1990
		– Air Force	TBD	Jan 1990
		– OSD Overview	TBD	TBD
Determine Future Architecture				
	Functional	– DLA	Oct 1987	Aug 1988
		– Army	May 1988	Jan 1990
		– Navy	TBD	Jan 1990
		– Air Force	TBD	Jan 1990
	Technical	– DLA	Oct 1987	Aug 1988
		– Army	May 1988	Jan 1990
		– Navy	TBD	Jan 1990
		– Air Force	TBD	Jan 1990
		– OSD Overview	TBD	TBD

3. Guidelines

The ODASD (Systems), in collaboration with the Comptroller, has produced a handbook that details the MAISRC process entitled "MAISRC Guidelines for Program Managers" which is aimed at assisting the program managers in better understanding and preparing for a MAISRC review. These guidelines provide an overview of the MAISRC review process, outline the composition and responsibilities of the MAISRC, encourage early and effective communication between the program manager (PM) and other responsible Component organizations and OSD staff personnel to assist in review preparation, and identify the types of reviews a PM may undergo. This handbook has been disseminated by the Comptroller for use throughout all of the Department. Volume 2 of the guidelines will provide additional information to those in P&L building and managing logistics systems.

D. Field Modern, Cost–Effective Systems

The P&L goal is to ensure all logistics ADP systems that are implemented are as modern as possible based on state–of–the–art technology and comparable applications in the commercial sector. P&L will ensure that out–of–date technology and old functional methodologies are not built into new systems or extended in present systems; this will be done by using controls in the planning process, advocacy before the MAISRC and budgetary actions where necessary. Likewise, P&L will not support systems in which the cost does not translate into improvements or benefits of some type. The actions P&L is taking to be sure that modern systems are fielded effectively include the following:

1. Sharpen Functional Requirements

Substantial effort is being applied to reviewing the functional requirements of major logistics ADP systems at both the OSD level and the Component level. For example, the Director of Supply Management Policy within the Office of the Deputy Assistant Secretary of Defense for Logistics (DASD (Logistics)) has established in–house teams for each logistics ADP system under its purview undergoing MAISRC review. The Deputy Assistant Secretary of Defense for Production Support prepared and the Under Secretary of Defense for Acquisition issued, the "Strategy for Bolstering the National Industrial Base." The Deputy Assistant Secretary of Defense for Environment has developed and is issuing a plan covering the areas under his purview. Functional plans of these types provide at least initial broad parameters within which specific functional requirements can be defined.

2. Involve OSD to a Greater Degree

P&L has increased significantly close coordination from concept inception onward with Components for logistics ADP systems that will be reviewed at the MAISRC level. For example, DASD (Systems) professionals are working with DLA throughout the process of formulating conceptual functional requirements (CFR) documentation for their Logistics Systems Modernization Program (LSMP). OSD personnel from both DASD (Systems) and DASD (Logistics) meet on a regular basis with the Program Managers and Component personnel responsible for these systems efforts, at both the management and implementation level. In many instances staff personnel of the other OSD organizations involved with the MAISRC process participate in this effort.

Concerted efforts are being expended to have the initial MAISRC presentation made to the principals earlier in the life cycle of logistics ADP systems. The MAISRC has, in many past cases, delegated to the top management of the involved Component and to the OSD sponsor the joint Milestone 0 (Mission Need) approval; frequently the MAISRC did not meet on that same program again until Milestone 1 (Concept Development) to approve the next stage of the system. Often, after Milestone 1 approval was granted, Milestone 2 (Definition and Design) was subsequently delegated to the Component. The Milestone 2 phase of life cycle management is, now too, being more closely monitored by the MAISRC principals. A greater number of MAISRC Milestone 2 reviews has been undertaken at the OSD level and an aggressive future schedule is being maintained.

OASD (P&L) plays an important role in these reviews. This role has increased. Recently, the Depot Maintenance Management Information Systems (DMMIS) portion of the Air Force Logistics Management System (LMS) was not approved by the MAISRC on the basis of OSD cost review identifying cost overruns and schedule slippages. Earlier, the DLA Logistics Systems Modernization Program, undergoing concurrent Milestone 0 and 1 review, was denied Milestone 1, due also, to OSD cost review.

3. **Assure Up–To–Date Technology Application and Insertion Capabilities**

The DASD (Systems) is reducing barriers between the laboratory and the user of ADP technology as a major initiative. DASD (Systems) is developing an aggressive technology transfer program to assure that existing systems are refreshed where economical and practicable, and that new systems offer the logistics user the best technology available for given logistics applications.

In addition, the DASD (Systems) is exploring greater use of ADP systems contract clauses to provide for upgrading hardware and software as the technology advances and manufacturers add to capabilities. DASD (Systems) is pushing Components to require the use of off–the–shelf products that are vendor/hardware independent to the highest degree possible.

In addition, as today's processing and communications systems become more complicated, we are turning to systems integrators to provide the complete system. If the contract language is well–constructed, systems integrators provide the ability to implement upgrade capabilities quickly and efficiently as well as to replace entire systems. The use of systems integrators allows the initial contract to cover the refreshment process throughout the life of the contract. The competitive process has to be pursued only once as long as there is not a subsequent change in the scope of the original contract. This approach is particularly applicable for large multipurpose ADP systems.

4. **Assure Diverse Systems Interface and Interoperate**

DASD (Systems) is working toward a world in which common DOD systems will be used by multiple Components where it makes operational and economic sense. Where use of a standard system is not practical, integrating systems will be sought. Department–wide programs exist and are being pursued to accomplish this integration. Examples were covered earlier in this section under the heading DOD–wide Logistics ADP Processing Systems.

The Comptroller recently revised the DOD Directive on Life–Cycle Management (7920.1). The Deputy Secretary of Defense approved this revision and approved also, a revised charter for the Comptroller. One of the principal features of these two documents is the focus on interoperability and standardization of Automated Information Systems (AIS). On July 11, 1988 the Deputy Secretary of Defense issued a memorandum to the ASDs (Production and Logistics), (Force Management and Personnel), (Health Affairs), and (Reserve Affairs) directing them to assist the Comptroller in maximizing benefits and cost savings through a number of detailed actions in the areas of interoperability and AIS standardization.

P&L, in response to the Deputy Secretary of Defense's memorandum, has developed an Standardization and Interoperability (S&I) action plan. This action plan addresses business/mission entities under P&L's oversight including supply, maintenance, transportation, requirements planning, logistics, procurement, installations and production support. The P&L approach anticipated at this time will be to concentrate on five specific areas: top level information architecture planning; standards; Component AIS plans; management approach; and policy review.

Major milestones for accomplishing the I&S action plan are:

- Determine Scope, overall approach and definitions by October 11, 1988
- Charter P&L S&I Steering Group by October 11, 1988
- Develop baseline and target architectures by July 11, 1989
- Establish Functional Working Groups as required
- Identify interoperability inhibitors and take corrective actions by July 11, 1989

- Establish Information architecture planning and control as an integral part of P&L's strategic planning and systems review process by January 11, 1990.

5. Reduce Lead Times in Fielding ADP

P&L, along with other OSD offices, has actions underway that will aid in reducing lead times to implement new and enhanced ADP systems. Three major areas of interest are: the acquisition process; in–house OSD review; and physical design, development and testing of systems. Examples of actions for each area follow:

(a) The acquisition process

In the first area, the Department, through P&L, has instituted an Acquisition Streamlining program which is directed at acquisition in general, not just ADP. The streamlining program identifies and corrects delays associated with the procurement process and some of the legal and regulatory requirements imposed on the Government. This program's goal is to make the Department's acquisition process more efficient and effective. The program's goals in reducing delays are aimed at saving both time and costs while still producing quality results.

(b) OSD review

As mentioned earlier, effort is being expended to involve the OSD staff early in the life cycle process so as to reduce the time required for OSD staff review downstream in individual programs.

(c) Design and development

The Department intends to exploit the many new and effective systems development tools that are becoming available, such as those ADP development products marketed under the banner of CASE (Computer Aided Systems Engineering) technology. These products are rapidly becoming more sophisticated and are available for most of the applications being performed manually, even to the point that actual computer code can be produced. Another area supported by P&L is the use of rapid prototyping in implementing systems applications. This methodology is very successful in development of functional systems, especially smaller applications.

Some of these efforts have begun to pay off. The streamlining initiative is moving forward, and most importantly, is receiving wide publicity including within industry. The Department has produced a DOD Directive on Acquisition Streamling Policy and the Components are joining in in furthering the concept. We believe we are seeing an improvement in requirements packages that will come before the MAISRC as a result of earlier OSD involvement and DASD(S) personnel have noted an increasing interest in CASE application in some of the Department's Central Design Activities engaged in logistics ADP modernization.

VI. CONCLUSIONS

A. Production and Logistics Manages a Complex, Integrated Universe

Department of Defense Production and Logistics organizational responsibilities encompass a large and complex domain. The total P&L responsibility touches on many aspects of: Government, state, local and federal; domestic and international commerce; defense in peacetime and wartime; industry; and the sciences.

In the procurement area alone the Department deals with approximately 300,000 vendors. The Department purchases millions of items and virtually every conceivable service to support thousands of sites and installations, and millions of personnel. In monetary terms, P&L is responsible for nearly four of every five dollars expended by the Department and includes personnel, operations, research and development, real property, and all Government supplies and equipment.

Growing demands for logistics support coupled with projected resource constraints require that DOD use its limited logistics resources wisely.

B. ADP is a Fundamental P&L Tool

A very high leverage way to improve DOD logistics performance is to invest in improvements to current ADP applications as well as the replacement of outmoded ADP systems.

ADP provides an efficient and cost-effective solution for keeping up with tremendous numbers of records that must be maintained and the millions of transactions that must be processed against those records. Additionally, ADP opens the avenue to obtain, manipulate, interpret and convey the information present in those processing systems. ADP also provides the bridge for the Department to make the transition from peace to war if the necessity arises. ADP is a key ingredient to logistics capability.

C. Continuous Planning and Management Are Needed

The expanse and complexity of the P&L mission require uninterrupted attention in management of the Department's logistics functions and their supporting ADP systems. Planning is crucial to mission management of both of these areas. The P&L Strategic Plan will allow OASD (P&L) and the Department to state clearly its goals and objectives in carrying out its future total mission. The Plan will be updated on a regular basis to adjust to changing circumstances.

D. Modernization Is a Necessity

Modernization is necessary to assure the continued effectiveness of DOD logistics support activities. The entire P&L logistics infrastructure is in need of modernization including, physical plants and logistics methods and procedures as well as ADP hardware, software and telecommunications. The high leverage and sheer power of the latter category make ADP and related systems modernization a top priority.

E. DOD Has an Effective Program to Modernize Logistics ADP

Through its major thrust areas the Department has an effective plan and is realizing gains in modernizing the P&L logistics ADP applications. The Department is applying modern hardware and software in transaction processing and modern methodologies as part of the approach to managing DOD production and logistics programs.

Many improvements have been made as part of the P&L goal of fielding modern, cost–effective systems, through greater attention to functional requirements, earlier involvement by OSD and the policy of securing up–to–date technology. Major efforts underway in the DASD (Systems), in support of the P&L goal to develop and use broad system–wide management tools, are providing a better understanding of the total P&L logistics ADP systems support picture. This is being accomplished through development of functional diagrams of Component and DOD–wide logistics systems, publication of MAISRC guidelines for the Components' use, and identification of the current and future architectures. Finally, our goal of developing and applying DOD–wide systems and standards is meeting with success; the major DOD–wide programs of EDI, CALS, and MODELS are moving forward according to plan.

F. A Measurement Process Is Required

If a plan is to be designed and implemented, then measurement is a necessity. In order to ensure that the plan is progressing and on track, some method of monitoring the progress of the plan must accompany and, in fact, be a part of the plan. This is doubly important in order to allow corrections to the plan throughout its life. In a perfect world, planning would not be necessary. Since planning is one attempt to control the future of the organization, the planning process itself must include sub–processes to identify and correct known and potential problem areas. The measurement part of the process, like the overall plan itself, is not a clear cut or one–time application, but must be considered throughout the life of the plan. Thus, some type of trend analysis must be pursued to determine in which direction the problems that are identified are moving, and whether the corrective measures are working.

The P&L Strategic Plan will dictate a measurement process for all of the component parts of the Plan at the corporate level. Actual implementation of detailed measurement processes, however, must be incorporated into the individual planning applications at the tactical level.

G. P&L is Exercising Greater Management Attention Over Logistics ADP

The Department acknowledges the premise by the House Appropriations Committee that the Department can improve its planning, policies, logistics programs and organizational structure. The P&L organization realizes that funding spent on logistics ADP systems support provides tremendous leverage in mission accomplishment and that unnecessary ADP systems expenditures must be prevented. DASD (Systems) will continue to decrease the duplication of systems as it actively participates in the planning, review and budget process within DOD.

The consolidation under DASD (Systems) of individual organizations that participate in the logistic ADP systems review and oversight, greater involvement of OSD in the review process, especially at the MAISRC level, and closer cooperation between OSD and Components' systems staffs all are contributing to improvements in and acceleration of P&L logistics ADP tools being put into the hands of the user. Increased functional management attention on the part of the individual DASDs within P&L and their staffs has also played an important part in bringing these improvements about.

LOGISTICS ADP

Question. What is the status of efforts to develop one. Is anyone in the Defense Department working it?

Answer. Because of significant strategic and financial changes impacting the DoD environment, the P&L Strategic Plan is currently under revision. The revised plan will include measurement criteria for ADP modernization and contain more specific management targets than the initial plan, that will be even more useful in monitoring progress of ADP planning and modernization. At the same time a large share of P&L resources are committed full time to logistics consolidation studies under the Defense Management Report (DMR) and to Corporate Information Management (CIM) teams. The success of these efforts will shape the future of DoD logistics well into the next century and will do so in an efficient and economical manner.

Question. Who in the Office of the Secretary of Defense is responsible for developing one, and why did he "drop the ball"?

Answer. One of the criticisms of the Committee in the FY 1988 Report was the lack of a single organizational responsibility for logistics ADP modernization within P&L. Logistics ADP functions were subsequently brought together under a Deputy Assistant Secretary for Systems. In addition to the activities described above, DASD(Systems) has responsibilities for P&L MAISRC program integration, CALS, MODELS, P&L standardization and interoperability planning, and integration of Service/Agency strategic and ADP planning efforts into the framework of the P&L Strategic Plan.

Question. How much is requested in fiscal year 1991 for DoD logistics ADP development and operation? Provide a detailed breakout for the record.

Answer. Funding is requested in fiscal year 1991 for DOD logistics ADP development and operation for the Military Services and the Defense Logistics Agency as follows:

FY 1991 LOGISTICS ADP DEVELOPMENT AND OPERATION

Service/Agency	Millions
Army	458.2
Navy	688.0
Air Force	384.0
Defense Logistics Agency	403.8
Total	1,934.0

Question. What is the current "total life cycle cost" estimate for all DoD logistics ADP systems being developed at this time?

Answer. The total life cycle cost estimate for all DoD logistics ADP systems being developed at this time is $17.2 billion.

Question. What action do you suggest we take to get DoD to focus on this long standing deficiency, should we reduce funding for logistics ADP systems or legislatively restrict their obligation?

Answer. From my perspective as Deputy Comptroller (IRM), I believe that the logistics community has improved its focus and is strongly supportive of the Defense Management Report, Corporate

Information Management and other initiatives that are of crucial importance to the DoD. I do believe that it is important that whatever action the Committee takes will permit progress in these areas. As to funding levels, logistics modernization efforts have been given a thorough scrub in putting together the FY 1991 budget in light of the CIM effort. The rigorous MAISRC oversight process that the Committee has called for, and that the Department has implemented, will serve as a further control over logistics ADP system development. Therefore, I believe no further legislative restrictions are necessary.

Question. How can DOD claim to implement a "Corporate Information Management" strategy if the Assistant Secretary of Defense has no strategic plan for over $6 billion of logistics ADP system modernization programs?

Answer. As mentioned earlier, there is a strategic plan which is tied to the Planning, Programing, and Budgeting System and is being followed by DOD Services and Agencies.

It should be noted that, under the P&L Strategic Plan's goal to modernize P&L information systems (listed in the plan as Goal 5.1), the first two objectives relate to the Corporate Information Management process. These objectives are:

1. Assess the critical information needs throughout production and logistics as the basis of improving and integrating information systems, and
2. Increase use of standards, common systems and components to improve interoperability.

The Corporate Information Management strategy is being applied to specific P&L business areas, such as distribution and materiel management. CIM functional groups related to production and logistics are being led by senior members of the OASD(P&L) staff. This should assist in successful implementation of objectives spelled out in the P&L Strategic Plan.

INDUSTRIAL FUNDING FOR ADP SYSTEMS

Question. The appropriations conference report for fiscal year 1991 gave specific instructions on industrial funding of ADP systems. This was done due to the Navy's nightmare ADP acquisition called STAFS, which was supposed to cost $54 million but ballooned to over $1 billion, it was then terminated after $200 million of wasted expenditures. The Appropriations Committees demand more visibility of and accountability for large ADP acquisitions.

Miss Kendall, please explain how DOD implemented the Appropriations conference limitations on the use of industrial funding for ADP systems.

Answer. The Conference Report stated that information systems development and acquisition of computer equipment for local administrative purpose (such as office equipment for a shipyard) may not be financed through industrial funds effective in FY 1991. DOD implemented this limitation by submitting the FY 1991 President's Budget consistent with the FY 1990 congressional direction to finance the Asset Capitalization Program in the procurement appropriations vice the industrial funds. Thus the Components' procurement budgets include funding support in FY 1990 and FY 1991 for industrial fund capital equipment and information systems development purchases which cost $5,000 or more and have an expected life of two or more years.

Question. The Navy plans a large CAD/CAM equipment purchase that may run in the billion dollar range. Why does the fiscal year 1991 budget to Congress show this initiative to be financed in the industrial fund rather than in appropriated funding?

Answer. In compliance with congressional direction, all industrial funding for investment items was transferred to the Other Procurement, Navy appropriation beginning with FY 1990. The industrial funding shown on the CAD/CAM budget exhibit in those years represents support costs rather than equipment purchases.

Question. Provide for the record by Service and system a listing of major automated information systems whose fiscal year 1991 costs are partially or fully financed with industrial funds.

Answer. The Army has no major automated information system that is partially or fully financed with industrial funds.

The Navy has two major automated information systems which utilize industrial funding for support costs. They are CAD/CAM and EDMICS. These systems also utilize funding from OPN appropriations.

For fiscal year 1991, the Air Force has a limited amount of money in the Depot Maintenance Industrial Fund (DMIF) for the Depot Maintenance Management Information System (DMMIS). Although the bulk of the DMMIS funding has been transferred to procurement, $2.4 million remains in the DMIF account.

Question. The Navy has a new start ADP program requiring $167 million in the Navy stock fund in fiscal year 1991. Why?

Answer. The Navy Stock Fund is not supporting a "new start." Rather, at the direction of DoD, the Inventory Control Points (ICP's) and Supply Depot operational support costs were moved from the Operations and Maintenance account to the Navy Stock Fund starting in FY 1991. Accordingly, SPAR, EDMICS, ICP, and SPLICE which were previously funded in O&M and OPN, are now funded in the Navy Stock Fund. Stock Fund accounting is based on actual material usage, and the ICP's will be able to make more accurate trade-off decisions between management and material costs. The Stock Fund ensures that the level of funding is more closely tied to actual workload rather than estimates made 24 months in advance.

[CLERK'S NOTE.—End of questions submitted for the record.]

THURSDAY, APRIL 5, 1990.

AUTOMATIC DATA PROCESSING PROGRAMS—DEPARTMENT OF THE ARMY

WITNESS

LT. GENERAL JEROME B. HILMES, USA, DIRECTOR OF INFORMATION SYSTEMS, COMMAND, CONTROL, COMMUNICATIONS AND COMPUTERS, HEADQUARTERS, DEPARTMENT OF THE ARMY

INTRODUCTION

Mr. MURTHA. The Committee will come to order. The committee would now like to focus on Army ADP in order to hear what has been done during the last year to respond to a number of significant management issues.

We are pleased to welcome Lt. General Jerome B. Hilmes, who is making his first appearance before the Committee.

You remember our hearing last year. Since you have taken over, Army ADP has changed. It is really impressive that a field commander like yourself would come in and be able to straighten this out, and you have apparently made substantial progress. We appreciate it. Because it was in disarray last year, we made significant cuts. In fact one of the most significant savings we made last year was in this area. The Department of Defense recognized that we were right and everybody started to focus on it, ranging from the problems at Cheyenne Mountain—which was a terrible hearing. Of course, that was an Air Force problem. We have gotten that straightened out, and they are now looking at command structure, as Ms. Kendall said before. So we appreciate the work that you have done.

I know you are requesting about $3 billion in fiscal year 1991. If you would summarize your statement, we will put your full statement in the record and get right down to questions.

SUMMARY STATEMENT OF GENERAL HILMES

General HILMES. Yes sir. If I might make a couple of points up front. I would hope to impress the committee that we have in fact made some significant management improvements in the Army's management stewardship of this area. I think one of the major allegations of the committee last year was that we didn't have enough visibility and enough centralized control of the Army's ADP effort. We looked at the audits, reports and investigations, and pretty well substantiated that.

The threshold at which we call programs up to the Pentagon to be examined was too high. We call those MAISRCs, a term I think you are familiar with. So one of the first things we did was we reduced the threshold from $50 million down to $10 million and we have visibility on systems down to $2 and a half million now in the building, systems at $2 and a half million come up for an architecture configuration sanity check.

Above $10 million they come up for MAISRC review. That has given us a lot more visibility on the systems that are in various stages of development and with the functional proponents. That is working very well. And I think, with this increased visibility, has come the realization that the Army is just terrifically automated. We have a lot of sustainment type activities automated, and we cannot pay people, we cannot stock or issue repair parts, or keep readiness up in our outfits today without our automated information systems.

These systems that are progressing in the field have a very high return on investment. Some are up around 5, 6, 7, 8. The average I would say from the systems I have seen, is around 1.8 to 2. So they amortize very fast, they pay off very fast, and they compensate for the force structure reductions and the monies that we have lost through various drills—some of which have already been mentioned this morning—so that the Army can essentially do more with less.

So those are the two main points I would like to leave with you, sir, as an opening comment. We have enhanced our management, our stewardship, and we really have automated our sustainability type functions in the Army. They are absolutely vital.

[The statement of General Hilmes follows:]

STATEMENT OF DEPARTMENT OF THE ARMY
OFFICE OF THE DIRECTOR OF INFORMATION SYSTEMS FOR COMMAND, CONTROL, COMMUNICATIONS AND COMPUTERS

LTG JEROME B. HILMES

HEARING BEFORE THE SUBCOMMITTEE ON DEFENSE
HOUSE APPROPRIATIONS COMMITTEE

APRIL 5, 1990

Mr. Chairman and members of the Subcommittee, I am privileged to appear before you today. I understand and appreciate your interest in Army automation and would like to tell you where we are, and where we are headed.

Over the past three years, the Army has had over 140 separate audits and inspections in the automation area. Each one has criticized our management of automation assets. Last year's congressional language reflected that criticism, cutting the Army $270M within automation, and additionally, placing a "CAP" on automation expenditures. The "CAP" meant that we could not conduct "business as usual". We have taken advantage of these events.

We have received your message and taken this criticism seriously. We fully recognize that sizeable and timely improvements in automation management are needed. As the Director of Information Systems, Command, Control, Communications and Computers, I have made this task my first order of business. I have personally talked to the Commanders or Chiefs-of-Staff of our largest Major Commands (MACOMs) and secured their support. They are all committed to having effective management systems. More on that later.

We have studied the audits and inspections to get a solid handle on our problems. We needed a written strategy for sustaining base automation, published policies, and "how to" pamphlets to implement policy. So, we did that. We looked at each MACOMs management of automation and instituted Life Cycle Management rules in the form of Army Regulation 25-3 to enhance their stewardship. MACOMs typically use management review committees chaired by a General Officer to prioritize and allocate resources based on the critically of need and return on investment. They also hold MAISRC-like reviews with thresholds for installation program review as low as $70,000 in USAREUR's case to $2.5 million in AMC's case. The bottom line is that stronger management controls over our automation assets are in place and being used at all levels of command.

The congressionally imposed "CAP" on expenditures, generated from this subcommittee, made us establish clearer definitions and better monitoring procedures. We had to assess "true" automation costs. As a result, we have instituted new cost accounting codes to track our automation expenditures. With this enhanced visibility comes more effective management and control.

We have focused on reducing costs, eliminating duplication and improving life cycle management. We have developed the Army Modernization Plan for Sustaining Base Automation. It categorizes and prioritizes our sustaining base automation programs. Additionally, the Modernization Plan is fiscally constrained by current Army guidance. Other initiatives designed to eliminate costly software duplication and drive out the unique software applications are the Army's Installation Support Modules (ISM) and DOD's Corporate Information Management or CIM Program. These two programs will not only significantly reduce software development costs, but also enable us to manage and contain fixed costs in the future. We want to attack the small software developments - literally hundreds of them - and convert them to standard MIS applications running across the Army.

We have taken some other management steps, reinforced at the highest levels of the Army, which will yield positive results. We have placed greater controls on new requirements and major programs by lowering threshold from $50.0 million to $10.0 million program cost for Army Major Automated Information System Review Council (MAISRC) approval. In addition, we have required our Major Commands (MACOMs) to conduct MAISRC-like reviews at their level with thresholds between $2.5 million to $10.0 million. We have expanded the role and authority of the Army's Architectural Control Committee or ACC. The committee now reviews all new requirements that cut across functional and MACOM boundaries. Improvements in data management - absolutely essential for interoperability - have been incorporated into major new systems like the Reserve Component Automation System or RCAS. Our Data Element Standardization program is now covered by appropriate regulatory guidance, Army Regulation 25-9. These positive management steps are being implemented in the field.

To ensure proper implementation of these management improvements, we have developed an assistance team which will make periodic visits to the Army's Major Commands beginning this month. Additionally, we have involved the functional users of these systems, the logisticians, the comptrollers, the personnel managers and others by conducting a series of functional reviews of their automation programs. Since they are the biggest users of automation, we want them to be a vital participant in the management of our automation resources and implementation of our strategy and architecture. The objective is a simple system addressing the appropriate management issues with no "red tape".

We are also doing something positive about those 140 audits and inspections. We have carefully reviewed each report, categorized the findings, and are rapidly resolving 191 separate issues. The actions I have summarized above have corrected our top priority issues and we are about 50% complete on the remaining ones. We expect all actions to be resolved by the end of this year. This effort has solved many of our long standing problems. We plan to report back to the auditors and inspectors and invite them to determine if our fixes have worked.

In the process of strengthening the Army's management and control of automation, we have had excellent cooperation and many success stories from our MACOMs and functional automation users. I'd like to share a few of their automation success stories with you.

US Army Europe (USAREUR) has fielded a Company Information System. This system provides a low cost automated tool to perform administrative and management tasks at the company level. It automates the function of training management, administration and property accountability using commercial software. The system has greatly reduced the volume of paper and the time required to accomplish small unit management. Thus, more time can be spent for mission-related tasks.

Our Training and Doctrine Command (TRADOC) has developed the Automated Retail Outlet System or AUTOROS. This system is an interactive database management system providing on-line data for inventory management and cost accounting. Its four modules provide service to 22 TRADOC installations supporting clothing issue, shop supply management, self-service supply center accounting and maintenance information management. The installations using AUTOROS have realized major benefits in controlling requisitions, prohibiting accumulation excess inventory and providing better support to soldiers.

The Army is now involved in a series of efficiency measures facilitated by automation initiatives embodied in the Strategic Logistics Program. One of these initiatives is the Unit Level Logistics System, ULLS. It is the baseline system to integrate all logistics functions. ULLS automates clerical workload performed by unit personnel, allowing them to work on actual repair. It began fielding an interim capability in May 1989 and is already enhancing productivity and readiness.

Another system, which will work with ULLS, is Standard Army Retail Logistics System or SARSS. This system provides automated stock record accounting and supply management. The objective SARSS software is in the design process. It will generate improved productivity and efficiency of operations.

We are now deploying a fully automated contracting system to 253 Army sites. Benefits of the Standard Army Automated Contracting

Systems or SAACONS are standardized procedures, reduction of procurement lead time and accurate and timely reporting. This system will not only expedite our lengthy procurement process, but also decrease our costs.

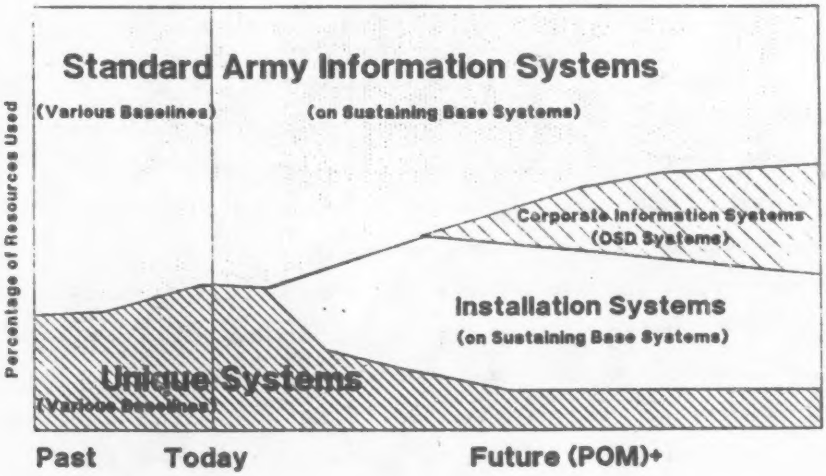
The Theater Army Medical Management Information System or TAMMIS aids medical personnel in transporting, treating, and tracking patients as well as managing medical material. This system operated flawlessly on our common hardware in Operation "Just Cause" in Panama. After only 9 days, 278 issues of medical supplies had been made using TAMMIS.

The Army Civilian Personnel System or ACPERS is a result of the Army's adoption of a successful Air Force system. This system provides a single civilian personnel system that complies with the OMB reform requirements.

These and other success stories have a common theme -- we have saved money and manpower while improving productivity and readiness. You will see more of these successes as the force structure is reduced and the Army's manpower and dollars brought down. We are trying to make smart automation investments with a high rate of return to compensate for these reductions.

The foundation for effective management of automation is largely in place. We have strengthened our Information Management Planning and Control Process to permit better linkage between requirements and resources, control growth and eliminate redundancy. Our Automation Strategy and the Modernization Plan will move us into an open system architecture, improve interoperability, reduce fixed costs, and further eliminate the costs associated with duplicative developments. A major program in executing this strategy is the Sustaining Base Information Services (SBIS) which will replace ASIMS in 1992. Together with Corporate Information Management and Information Support Modules, SBIS forms the centerpiece of our plan to move into the Open Systems Environment and transition software applications. These programs are in the execution phase of the plan which will allow us to reap the benefits of automation and vendor-independent hosts. We will then be well positioned for the next century. The chart below displays our new way of doing business -- more standard systems under the CIM and ISM programs -- and fewer uniques systems as we move from today to the future.

NEW WAY OF DOING BUSINESS



We believe that we have taken positive management steps in responding to past criticism. I am encouraged with the progress made thus far. Strong control and management of automation remain my number one priority.

I appreciate this opportunity to share with you the direction in which the Army automation is going. I will continue to keep you advised of our progress. I am ready to respond to your questions.

MANAGEMENT ISSUES

Mr. **Murtha**. Your statement indicates that you had 140 separate ADP audits and inspections in the last three years, which identified 191 separate issues needing your attention. Of course, we appreciate the work that you have done, because last year the hearing was a disaster. Do you agree with our assessment that there was something seriously wrong with Army ADP in the past?

General **Hilmes**. We had a lot of serious problems, sir, and we are working on those. It is a large, complicated field, so there will be some problems for a while, but I think we have made significant progress in turning those around.

Mr. **Murtha**. Something we talked about before the hearing started that concerned me a little bit is instability. The concern is in the Services themselves—the young officers are concerned, and the senior officers too—nobody knows what direction we are going. You translated that into your authority and your organization, and how you are not getting people in, and you can't send them to school.

Talk about that a little bit, because obviously we are trying to make the appropriate decisions this year, and not lose the expertise and the readiness that we have developed over the last ten years. We have spent a lot of money. We certainly don't want to regress.

It sounded like you are saying in your organization that there are some problems there not only because of instability, but because of lack of money. Talk about that.

General **Hilmes**. I am saying we need those $3 billion, because every system from the moment that a young person in the country steps into a recruiting station, and wants to join the Army, Navy, Air Force, or Marines, and he goes into the military entrance processing station and he goes to a basic course someplace, all those functions are automated.

There is an acronym for each one of those. You get a reservation at some school to go get your basic training, or your officer training, or specialist training, all through an automated system. Each one of those is either old and being replaced or redesigned, or being fixed so that it works faster and better. So we can continue to do those functions typically with less people.

I spoke about the personnel management and administration people, young sergeants that are working 50 hours a week in the units in the personnel administration centers of their battalions, because the automated system that they have today doesn't do as much and doesn't do it as fast as it should. So they are working hard, working longer hours than their sergeant's pay would reasonably justify.

So one of our top priorities is to get that new system out—I am talking about SIDPERS-3—to solve those problems in those PACs and personnel service companies. All of those functions are automated, sir, and some of them are very old and need to be replaced.

Mr. **Murtha**. I want to make sure I understand what we talked about. You said your guys are working extra hours a week trying to keep up with the instability and the bottom line, or top line changes, whichever way. You went on to say that in your organization you can't send people to school and so forth, and I am trying to understand if you have enough money to operate efficiently.

For instance, if there is anything we see as a problem it is this ADP and software. In the weapon systems they used to say it is just a software problem, no big deal. That held up the C-17 for I don't know how many years and it is a substantial problem. I am asking do you have the money or is it just the instability of what is going on that is causing the problem? I am trying to understand what the problem is here.

General **Hilmes**. I think we got that issue a little confused, sir. The extra hours a week, those people are my staff in the Pentagon and that is just due to the uncertainties in the world today and the uncertainties of the force structure reductions.

Mr. **Murtha**. So things are changing so much you have to keep changing to keep up with it?

General **Hilmes**. Yes sir. That has nothing to do with the more important problem, the ability to support the soldier in the field, and to sustain the readiness of the Army.

Mr. **Murtha**. You said people not being able to go to school, are you talking about in the field?

General **Hilmes**. Yes.

Mr. **Murtha**. Talk about where you are with that and what is causing that.

General **Hilmes**. Let's take that example. The soldier that is leaving basic training at Fort Benjamin Harrison or Fort Leonard Wood, or someplace. When he needs an appointment, if you will, at the next course that he will go to, that system is an automated system. If the automated system is not there, then the process of getting this soldier trained and into the Army fully, has a hard time happening. And the reason it is automated is because we are doing those kinds of functions with less people today.

Mr. **Murtha**. It sounds like you are saying, though, that what we had was a management problem—we believed it was a management problem. Is this what you believe?

General **Hilmes**. Yes sir. We still have management problems. I was just making a case for the fact that all those automated systems out there are doing great things for us in terms of enhancing our productivity.

AUDIT ISSUES

Mr. **Murtha**. What is the status of the 191 issues which you have uncovered in your audits?

General **Hilmes**. We have made a lot of progress on those, sir. We have fixed about 50 percent of those already. We will have the rest fixed by the end of the year but we have fixed the most important ones.

Mr. **Murtha**. Clarify that for the record.

[The information follows:]

To date, 101 of the following have been completed. An additional 49 issues should be resolved by the end of September, with the remaining 41 issues resolved by the end of December. The following table shows the status of each of the issues grouped by functional area and by individual issue short title.

COMPLETED CORRECTIVE ACTION PLAN (CAP) ISSUES:

FUNCTIONAL AREA	ISSUE SHORT TITLE
Accountability	DOD REPORTING REQUIREMENTS
Accountability	ADPE ACCOUNTABILITY
Accountability	ADPE REPORTING
Accountability	INADEQUATE SOFTWARE CONTROLS
Acquisition	ACQUISITION APPROVAL
Acquisition	ACQUISITION APPROVAL PROCESS
Acquisition	ACQUISITION THESHOLDS
Acquisition	COMMON COMPUTER ACQUISITION
Acquisition	TRADOC DSS
Acquisition	VISUAL INFORMATION ACQUISITION
Acquisition	SOFTWARE ACQUISITION
Acquisition	PROPRIETARY ENVIRONMENT
Acquisition	COMPETITIVE ACQUISITIONS
Acquisition	DPA OVERSIGHT
Acquisition	ISSAA FIELD AUDITS OF DPA
Acquisition	ISSAA ACQUISITION REVIEW
Acquisition	INFORMATION SYSTEM INCREMENTS
Acquisition	FRAGMENTED ACQUISITION
Acquisition	STANDARD CONTRACTS
Acquisition	FIS MANAGEMENT
Acquisition	LEASE VS. PURCHASE CONTROL
Acquisition	CASE TOOLS
Acquisition	MAISRC
Architectures	ARCHITECTURAL CONTROL COMMITTEES
Architectures	AIA DEVELOPMENT
Architectures	OBJECTIVE CONFIGURATION
Architectures	ACC MEMBERSHIP
Architectures	IRS LINKAGES
Architectures	IRS PREPARATION
Life Cycle Mgmt	AR 25-3 CONFLICTS WITH FIRMR-41
Life Cycle Mgmt	LCM REGULATION
Life Cycle Mgmt	LCM PROCEDURES
Life Cycle Mgmt	INCONSISTENT LCM REGULATIONS
Life Cycle Mgmt	INTEGRATE LCM DIRECTIVES
Life Cycle Mgmt	MAISRC MILESTONES CONSOLIDATION
Life Cycle Mgmt	ASIMS MILESTONE CONSOLIDATION
Life Cycle Mgmt	TPUMF IN SYSTEM REVIEWS
Life Cycle Mgmt	TPUMF IN ARCHITECTURAL REVIEWS
Life Cycle Mgmt	PROGRAM CONTINUITY
Management	SUSTAINING BASE PERCENTAGE

Management	ISC AUTOMATION IMBALANCE
Management	IMA MANAGEMENT
Management	ADA TECHNICAL ISSUES
Management	PROJECT DESIGN
Management	ADA PROJECT INVENTORIES
Management	ADA IMPLEMENTATION COSTS
Management	IMA MANAGEMENT
Management	LEADERSHIP CONTINUITY
Management	ACPERS MANAGEMENT
Management	ARCHITECTURE CONTROL COMMITTEE
Management	HF RADIO INTEROPERABILITY
Miscellaneous	REPACKAGE BRIEFINGS
Miscellaneous	UNFINANCED REQUIREMENTS
Management	ASIMS PERSONNEL PROCESSING
Management	FORCEBUILDER/TAADS-R
Management	RCAS
Management	STARCIPS-R
Management	STANFINS-R
Management	CHS REQUIREMENTS
Management	ULC POLICY
Management	STAMIS SOFTWARE DEVELOPMENT
Management	STAMIS INTERFACE
Management	RCAPSS
Management	MPR-JSS/PERSONNEL INTERFACE
Plans	RESPONSIBILITY FOR LONG-TERM DIRECTION
Plans	IMP REVIEW
Plans	COMMERCIAL SOFTWARE REQUIREMENTS
Plans	COMMERCIAL SOFTWARE ACQUISITION
Plans	SOFTWARE/HARDWARE COMPATIBILITY
Plans	IMP POLICY
Plans	COMMUNITY/GARRISON IMP INITIATIVES
Policies	REAFFIRM IMA CONCEPT
Policies	AMEND AR 5-3
Policies	UPDATE AR 5-9
Policies	INFORMATION SYSTEM SECURITY
Policies	SECURITY FUNCTIONS
Policies	POLICY GUIDANCE
Policies	DOIM COORDINATION
Policies	FUNCTIONAL USER COORDINATION
Policies	FIELDING ORGANIZATIONS
Policies	LOGISTICS SUPPORT COORDINATION POLICY
Policies	INFORMATION CENTER TRAINING
Policies	INFORMATION CENTER RESOURCE POLICY
Policies	INSTALLATION INFORMATION CENTER RESOURCES
Policies	ISM POLICY
Policies	COLOR CODED DISKS
Policies	AR 25-1 - THEATER/TACTICAL ENVIRONMENT

Policies	COMPUTER SYSTEM SECURITY
Policies	INTEGRATION AND INTEROPERABILITY
Software	SOFTWARE LIBRARY
Standards	SECURITY ACQUISITION STANDARDS
Standards	FAX INTEROPERABILITY
Standards	HF RADIO ARCHITECTURE
Standards	HF RADIO STANDARDS
Standards	FIPS STANDARDS
Standards	IRM STANDARDIZATION
Standards	JOINT VS. NATO STANDARDS
Standards	TRAINING REQUIREMENTS FOR PM'S
Standards	STAMIS PORTABILITY
Training	OPM IMA CAREER SERIES
Training	ACQUISITION CAREER DEVELOPMENT

CORRECTIVE ACTION PLAN (CAP) ISSUES TO BE COMPLETED BY SEPTEMBER 30,1990:

FUNCTIONAL AREA	ISSUE TITLE
Accountability	BASELINE CONFIGURATION
Accountability	INVENTORY CONTROL SYSTEM
Accountability	DATA LINKS
Accountability	ADPE INVENTORY MANAGEMENT
Accountability	AR 25-1 -- ASSET VISIBILITY
Accountability	CURRENT TARGET CONFIGURATION
Accountability	ARPMIS
Accountability	BASELINE STANDARDS
Accountability	ARPMIS EXECUTION
Accountability	BUYOUT INVENTORY INACCURATE
Architectures	SUSTAINING BASE CONFIGURATION
Architectures	DA PAM 25-1
Management	IMA ENVIRONMENT CONSISTENCY
Management	IMA DOCTRINAL RESPONSIBILITIES
Management	SYSTEM INTEGRATION
Management	CHARGEBACK
Management	ADP BUDGET MANAGEMENT
Management	FINANCIAL MANAGEMENT DATA
Management	MACOM ADP INCOMPATIBILITY
Plans	IMP INEFFECTUAL
Plans	IMP PROCESS
Plans	IMP MONITORING
Plans	IMP PROBLEMS
Plans	IMP POLICIES AND PROCEDURES
Plans	PPBS, IMP, LRRDAP, IMMP, ARMY PLAN, AND DEFENSE GUIDANCE
Plans	IMP FUNDS PROGRAMMING
Plans	IMP GUIDANCE TO ARMY

Plans	IMP REQUIREMENTS VS. SOLUTIONS
Plans	IMP ORIENTATION
Plans	POORLY DEFINED REQUIREMENTS
Plans	IM COUNCIL
Policies	DESIGNATE IMA PROPONENT
Policies	PUBLICATION OF POLICIES
Policies	AR 25-1 - USER TRAINING
Policies	AR 25-1 - DEFINITIONS AND GUIDANCE
Policies	AR 25-1 - INADEQUATE GUIDANCE
Policies	FIELDING GUIDANCE
Policies	FIELDING COORDINATION
Policies	STOVEPIPE TRAINING
Policies	STOVEPIPE FIELDING
Policies	STOVEPIPE RESPONSIBILITIES
Policies	SUSTAINING BASE POLICY
Policies	STOVEPIPE COORDINATION
Standards	DATA STANDARDIZATION
Standards	PRIORITIZE DATA STANDARDIZATION
Standards	HQDA DATA MANAGEMENT
Standards	DATA MANAGEMENT PROGRAM
Standards	FORCEBUILDER ADA EXCEPTION
Training	IMA PROFESSIONAL DEVELOPMENT TRAINING

CORRECTIVE ACTION PLAN (CAP) ISSUES TO BE COMPLETED BY DECEMBER 31, 1990:

FUNCTIONAL AREA	ISSUE TITLE
Architectures	REALISTIC GUIDANCE
Architectures	CLARIFY POLICY
Management	CTASC II
Management	MPR-JSS/NGB
Management	MPR-JSS/FORSCOM
Management	MPR-JSS/USAFAC
Management	STARCIPS-R
Management	EAC DATA REQUIREMENTS
Management	IRM CHECKLIST
Management	IRM FRAGMENTATION
Management	DISPOSITION OF EQUIPMENT
Management	ADP INTERNAL CONTROL
Plans	IMA ORGANIZATIONAL STRUCTURE
Plans	TDA RESOURCE DISTRIBUTIONS
Plans	MITIGATE AOE REDUCTIONS
Policies	REVISE AR 5-22
Policies	IMA PERSONNEL PROPONENT
Policies	DISCRETIONARY PROCUREMENTS
Policies	STAMIS IN AMIM
Policies	ARMY MODERNIZATION INFORMATION MEMORANDUM (AMIM)

Policies	OFFICIAL MAIL PROGRAM
Software	SOFTWARE DEVELOPMENT POLICY
Software	T/A SOFTWARE DEVELOPMENT
Standards	PROGRAMMING LANGUAGES
Standards	DATA STANDARDIZATION MOE
Standards	DATA MANAGEMENT
Training	THEATER/TACTICAL IMA DOCTRINE
Training	IMA TRAINING IN SERVICE SCHOOLS
Training	END USER TRAINING
Training	IRM TRAINING
Training	SIGCEN IMA TRAINING TASKER
Training	STAMIS TRAINING
Training	SIGCEN IRM TRAINING
Training	AUTOMATION TRAINING SURVEY
Training	AUTOMATION TRAINING TESTS
Training	CLT PROGRAM
Training	SELF-PACED AUTOMATION TRAINING
Training	TRAINING STRATEGY
Training	IMA CAREER PROGRESSION
Training	DOIM CAREER PATHS
Training	IMA TRAINING FOR LOWER GRADES

Mr. MURTHA. Mr. Young.

BUDGET GROWTH

Mr. YOUNG. Thank you, Mr. Chairman.

General, I would like to talk to you for a few minutes about the growth of the budget. Last year Congress reduced the Army's fiscal year 1990 ADP budget request for $2.5 billion by about $.3 billion. The new budget requests $3 billion, which is an increase of nearly a billion dollars from last year's appropriations. What has caused the Army to request such a large budget growth this year for ADP?

General HILMES. Sir, when you go and compare apples to apples, baseline to baseline, our total program growth is $240 million. When you strip out inflation and pay raises, you are talking a programmatic growth of $131 million. I submit that is what we need to keep abreast of updated automation systems that I have been talking to the Chairman about.

Mr. YOUNG. So the information that we are working from that it was a 36 percent increase is not accurate?

General HILMES. That is not real program growth, sir. That is a combination of many things. But the real programmatic growth is $131 million.

ANTI-COMPETITIVE STANDARDS

Mr. YOUNG. We will take your word on that. Last year we discussed with your predecessor the fact that former Deputy Secretary of Defense Taft directed the Army in 1987 to withdraw standards that the Army had published, which limited competition for ADP equipment. Ms. Kendall also testified last year that her office had not yet approved new Army standards at that time.

Is it true that Mr. Taft made you withdraw your standards?

General HILMES. Yes sir.

Mr. YOUNG. Do you know why? Tell us what the reason was.

General HILMES. I think it was basically the feeling that those standards would reduce competition, sir.

Mr. YOUNG. Have you replaced those standards? What standards are you using today?

General HILMES. We have moved to industry standards, Department of Defense standards. We have only one area wherein the Army has the lead on standards. That is in standardized data elements and we are trying to get OSD to take us as the example on that one.

Mr. YOUNG. Are your standards published?

General HILMES. They are Department of Defense and industry standards that are available in the normal periodicals.

Mr. YOUNG. So there will be no need for us to have your standards listed in our record at this point?

General HILMES. Other than the standards on data elements, which is AR 25-9 which the committee has.

Mr. YOUNG. Has OSD formally reviewed and approved these standards?

General HILMES. Yes sir.

STRATEGY FOR ARMY CONUS BASES

Mr. YOUNG. The $10 billion contract which provides computer processing equipment and services to the Army CONUS military bases expires in 1992. The current system is named VIABLE. What is your strategy for replacing it in 1992?

General HILMES. We intend to replace ASIMS VIABLE with a new system called SBIS, Sustaining Base Information Services, which will in phase I continue the services provided now by VIABLE and transition over in a subsequent phases to what we call an open systems environment. That means a vendor independent environment. And eventually, all of our new information systems will run on this open systems environment.

This means that as we have to replace those platforms in the future, we can have free and open competition across all vendors because we will not be tied to a proprietary system.

Mr. YOUNG. General, who in the Army is going to be responsible for preparing these functional requirements that the new system is intended to satisfy?

General HILMES. I will be the focal point on that, sir. I will collect them all. The actual functional requirements, as the name implies, will be developed by the functional proponent. By that I mean people like the DCSPER for the personnel community, the DCSLOG for the logistics community, and so forth. But I will collect them and make sure that they are a coherent set.

Mr. YOUNG. General, I have additional questions on the strategy for the Army CONUS bases. Please respond to them for the record.

[CLERK'S NOTE.—Questions submitted by Mr. Young and the answers thereto follow:]

Question. The ten year, billion dollar contract which provides computer processing equipment and services to all Army CONUS military bases expires in 1992. How will major command unique requirements be captured and satisfied by this acquisition?

Answer. My staff will inventory all the major command (MACOM) and installation unique applications and consolidate their processing requirements. I have organized a survey team to visit each MACOM. The team will work with the Deputy Chief of Staff for Information Management and MACOM functional personnel to establish an applications software baseline.

Question. Do you plan an acquisition that fully complies with the normal procedures of OMB Circular A-109?

Answer. Our current acquisition strategy calls for full and open competition with industry proposing the optimal design solution based on the functional requirements.

Question. What is the Army "capstone" architecture cited in the SBIS acquisition strategy released to industry? Which Army document explains it?

Answer. The Army Information Systems Architecture-Circa 1997, dated November 1989, explains the capstone architecture. Our objective configuration focuses on two Information Mission Area goals (data management and open systems standards) aimed at improving information services for the sustainment and readiness of our forces at minimum cost. As documented in Army Regulation 25-9, The Army Data Management and Standards Program, management controls are being implemented to standardize data elements, reduce data redundancies, and share data across applications. It is also our intent to employ open system standards to enhance competition and end user dependence on vendor unique solutions.

Question. How much influence will the current inventory of IBM oriented hardware and software have on the recompetition?

Answer. None. The source selection evaluation criteria is being structured to level the playing field. For example, the Government will bear the costs to relocate Goverment Furnished Equipment as to discount any competitor advantage.

Question. How many modules for SBIS does the Army plan to implement, and when?

Answer. Current strategy is that SBIS will consist of several competitive acquisitions. The first acquisition (or Module 1) will continue to support those services currently being provided by the Army Standard Information Management System (ASIMS) and establish a baseline for those Standard Army Management Information Systems (STAMIS) that have been or are being redesigned to process in an Open System Environment (OSE). Subsequent modules will support other STAMIS and generic installation support programs as they are redesigned or as economics dictate.

Question. In what specific areas has the Army adjusted this plan for impending troop cuts, base closures and budget reductions?

Answer. Our cost estimates have been adjusted to reflect consolidation of data processing installations, base closures, and force structure reductions as identified to date.

[CLERK'S NOTE.—End of questions submitted by Mr. Young.]

Mr. YOUNG. Thank you very much.

Thank you, Mr. Chairman.

COMPUTERS FOR THE ARMY RESERVES

Mr. MURTHA. Mr. AuCoin.

Mr. AUCOIN. Thank you, Mr. Chairman.

General, I would like to ask a series of questions about computers for the Army Reserves. Congress has been struggling with the Army and with Department of Defense for something like 12 years, as you know, on the question of fielding a modern computer system for the Army Reserves. The system is called RCAS—the Reserve Component Automation System. It is essential to mobilize, as I think you agree, the Army during wartime.

It seems that this committee, certainly to this Member, that recent world events make the system even more critical today as additional functions are transferred to the Reserves and maybe more are going to be transferred to the Reserves in the future.

My first question is, is the RCAS acquisition finally now moving forward at a satisfactory pace?

General HILMES. Yes, sir, I certainly think it is. The RFP is out, the responses are due back and the functional requirements have been well written, and well staffed within the building. I think it is making excellent progress.

Mr. AUCOIN. Describe for the committee your working relationship with the Guard and Reserve officers who are charged with managing the program. This has been a point that has been explored in this committee in the past as you well know. How would you describe that relationship today?

General HILMES. Very, very close, sir. We are working very closely with the Chief of the National Guard Bureau, both the old one and the new one.

Mr. AUCOIN. Close could mean at each other's throats or something else.

General HILMES. Close and amicably. The Chief of the National Guard Bureau and I have joint monthly reviews of the program. We work very closely and well with the program manager for RCAS. We have assisted his efforts in getting his product coordinated through the Pentagon. I support him with procurement support. We work well together, I think.

Mr. AUCOIN. I was going to ask you how in fact you provide assistance. I guess you have just given a description of the kind of assistance you provide.

General HILMES. We are kind of his technical advisor and assistant and my staff has been charged with making his program a success.

Mr. AUCOIN. So it is assistance rather than interference?

General HILMES. Absolutely.

Mr. AUCOIN. Are you committed to fielding this system on a timely basis and in full compliance with the law?

General HILMES. Absolutely.

Mr. AUCOIN. How is RCAS outyear funding holding up in the internal Army fiscal year 1992 POM budget reviews?

General HILMES. It is fully funded, sir.

Mr. AUCOIN. Those are excellent answers and certainly a breath of fresh air.

General HILMES. We have gotten the message, sir.

Mr. AUCOIN. Sounds like it.

General HILMES. We are working hard at it. Maybe we will reach the top 100.

COMMITMENT FROM ARMY COMMANDERS IN CHIEF

Mr. AUCOIN. Let me compliment you, because I think you know that I have been among those who have been very critical in the past.

Let me switch to the commitment you are getting from the Army CINCs in resolving army ADP problems. About 76 percent of this business is O&M funded and much of your problem in cleaning up ARMY ADP, as a three star in the Pentagon, lies in telling four stars who are field commanders how to do their jobs, which is a delicate proposition. Your statement indicates you have personally talked to them about the sizable and timely improvements needed in the Army automation management area. What have you told them and how have they responded to you?

General HILMES. In a word, sir, very well.

What we have told them is that we have to eliminate duplication. We have to make sure that the right business questions are asked before we launch or put significant money into automated systems, and they have cooperated fully.

When we reduced the threshold, that meant a lot of systems that they had run before were now coming up to the building for review.

Mr. AuCoin. That is a new development?

General Hilmes. That is a new development. That is a significant lowering of the threshold to bring a program in from the field. But all in all, sir, they are throwing their lot in with us and they have been full and willing partners in all these management changes that have been initiated.

Mr. AuCoin. I would expect, as all these disparate systems and intentions and so forth are rationalized into a coherent whole, that there would be command unique systems that would have to be given a stop order. Have there been?

General Hilmes. Sir, I have called in several command and installation unique systems. We have restructured some. We have redirected some. We have down-scoped some, but we have stopped none, and that is because, as I was telling the Chairman earlier, each of these systems, they have inherent goodness in them, benefits that are being realized——

Mr. AuCoin. You are telling the committee you have shaped them in a way that is rational?

General Hilmes. Yes sir.

Mr. AuCoin. What instructions and latitude has the Chief of Staff, General Vuono, given you concerning improvements in the Army ADP process?

General Hilmes. I came on board about the time I think last year that General Vuono and the Chairman were talking about the cuts that have been mentioned, and so I may have gotten a little more specific guidance than most. He said that we have to improve our stewardship in this arena. He said that in a four star conference. That probably helped my conversations with the four stars that you alluded to.

So his guidance was very supportive and it has continued that way.

Mr. AuCoin. So when you are talking to the four stars the shadow of General Vuono is cast over these conversations—he is backing you up?

General Hilmes. We are all in it together.

Mr. Murtha. This committee has had a major role to play in this. Ms. Kendall and General Hilmes have really done a good job. We appreciate the change.

Mr. AuCoin. Absolutely. When I said a breath of fresh air, I meant it. This is a big change compared to what we have been grappling with in the past.

What efforts do you have for on-site inspection of Army field activities by personnel in your office to ensure as time goes on, that new policies are working?

General Hilmes. My management assistance team has just initiated their first trip to MACOMS this week. They came back in one piece and reported good progress.

Mr. AuCoin. The TRADOC and FORSCOM are the two largest CONUS commands whose ADP programs have been troublesome in the past. Can you describe what is being done differently today by them compared to a year ago?

General HILMES. Yes sir.

TRADOC and Forces Command have embraced the guidance we gave them in our life cycle management which means they conduct MAISRC reviews at their level for systems under $10 million. Both commands have passed that philosophy on to the installations in their commands and given their installations very low thresholds also, lower than $200,000. So, anything beyond $200,000 down at an installation comes up to that MACOM for a MAISRC-like review. That goes through all the life cycle management principles.

That review committee is chaired by a general officer, typically the Chief of Staff of that MACOM. So those kinds of reviews will help a lot.

They also cooperated fully with an initiative that we have ongoing that we call the installation support module, whereby we do a generic housekeeping function one time, like registering your vehicles or centralized in-processing for new soldiers, and then that becomes the way for the whole Army.

TRADOC particularly had some ways of doing that. We have taken the best of the breed approach, and so that is a program that we are launching there. They are fully supporting that. That will eliminate a lot of duplication.

Mr. AUCOIN. General, I just want to thank you for your testimony and thank you for the good work that you are doing. This is a very satisfactory hearing in terms of what I am gleaning from the testimony and I just want to compliment you for the significant improvement we have heard.

General HILMES. Thank you, sir.

On behalf of a lot of Army people that have been working this, I thank you.

Mr. MURTHA. Mr. McDade.

VERTICAL INVENTORY MANAGEMENT SYSTEM

Mr. McDADE. Thank you, Mr. Chairman.

General, as you know, we have had a continuing problem with respect to inventory control across the spectrum of the Services and we have been proposing considerable sums of money to try to get our arms around that problem. Particularly when we are faced with declining budgets and you hear about excess inventory, it really makes a very, very difficult problem for you and the people over across the river and for all of us on this side who have a responsibility for the budget. We have invested a lot of money to help you get your arms around the logistic problem of inventory control, kind of from cradle to grave so we didn't have one side buying items that were declared excess in other areas.

Has that problem been solved?

General HILMES. There are two parts to that problem, sir, and this is in the DCSLOG arena. We are supporting him in terms of automating his systems to do that. He has some systems that are being deployed this year and next year that will go a long way toward addressing that problem. He has got some more to do, though, and he groups them all together in a concept called strategic logistics program, or SLP. We have been working with the DCSLOG to make sure that those systems fit together.

Today, part of the problem is that we still have PLL, the clerks down in the units, that get your repair parts for you inputting their requirements by hand, punching up cards. We have a new automated system that will replace that.

Mr. McDade. When is that going to happen?

General Hilmes. That has happened.

Mr. McDade. When is that in place and you have the cradle to grave computer track on every item that gets purchased?

General Hilmes. When we have the cradle to grave system from the foxhole to the depot, a completely seamless system, no wholesale, retail concept any more—that will be years.

Mr. McDade. How many years would you guess?

General Hilmes. I think it will take three or four years. It will be in phases, but we have the first phases well underway.

Mr. McDade. You have got the first phases underway, you are simply waiting for resources and time, you have no discussions or disagreements about systems. You can say to the Secretary this is the system that will operate cradle to grave and will prevent any duplicative buys or that kind of thing. Is that your testimony?

General Hilmes. Yes sir. We think that is a terrifically important system. We think it has the capability of a $2 billion cost avoidance. It will get at the duplication——

Mr. McDade. Is that an annual cost saving?

General Hilmes. I don't think it will be annual but there is a lot of money in the logistics pipelines.

Mr. McDade. You bet. This committee suffers from that because people look at the inventory and criticize the management of it and there is lots there to criticize, but we understand it is a heck of a big job for the military to have enough inventory to do its work. You say $2 billion savings. What do you mean by that? How are you defining those $2 billion in savings? Are you saying that is $2 billion less we have to propose for spares as we go along?

General Hilmes. Sir, I will defer that to the DCSLOG. As you can appreciate, if you automate the system from the soldier to the depot you are saving many days of supply that normally resides in the pipeline. Those are millions of dollars a day.

Mr. McDade. How much is it going to cost to implement that system in your judgment, as we go down the road over the next two or three years?

General Hilmes. I would hazard a guess of about $400 million.

Mr. McDade. As far as you are concerned, you are getting the kind of cooperation you need and there are no horror stories or show stoppers out there now that would prevent you from getting vertical integration of inventory?

General Hilmes. Yes sir. Everybody is on board because the Secretary has said it is a top priority program for the Army. I seek your support in our rather meager 4.9 percent growth that I mentioned, $131 million, because that strategic logistics program is part of that growth.

Mr. McDade. Thank you very much, Mr. Chairman.

Mr. Murtha. Any other questions?

Thank you very much, General. We appreciate it. We appreciate the substantial improvement and look forward to working with you. We will have other questions for the record.

The committee will adjourn until 1:30 p.m. this afternoon.

[CLERK'S NOTE.—Questions submitted for the record and the answers thereto follow:]

MANAGEMENT ISSUES

Question. Your statement indicates the Army has had over 140 separate ADP audits and inspections in the last 3 years, which identified 191 separate issues needing your attention. In layman's terms, tell us the main management problems that were identified to you by these audits. Discuss your "Corrective Actions Plan".

Answer. The main management problems primarily focused on either an absence of effective policy and guidance or a lack of enforcement and control of existing policy and guidance. Our most significant problems were in the following generic areas:

IMA Planning Process: Generally, the planning process was identified as not effective, not resource constrained, and not linked to the programming and budgeting process. A systematic review of the process resulted in issuing new guidelines and the development of a "How To" planning pamphlet.

Life-Cycle Management of Information Systems: Life cycle management policy, guidance and procedures were either not available or were inadequate. The publication of the Life-Cycle Management Regulation (AR 25–3) has filled the void in this area.

Acquisition Process: IMA resources were being acquired in a manner inconsistent with good management practices and there was a need to streamline and enforce acquisition policies and procedures. The publication of the Life-Cycle Management Regulation, which lowered threshold levels for oversight and requires MAISRC-like reviews at MACOM level should provide some significant improvements.

Controlling Automation Costs: There is an absolute need to gain cost control. The steps we are taking in funds tracking, establishing base costs of automation, and revising the Information Technology Systems Budget (ITSB) baseline will significantly help control this shortcoming.

Eliminating Duplication: There is a need to maximize shared software applications/programs and to minimize proprietary systems. The strategy established in the "Army Strategy for Sustaining Base Automation" and the new policies and regulations concerning software development have helped in this area.

The Corrective Action Plan was developed by my office with the involvement of the DA Headquarters Staff and Major Commands. The plan addressed issues which were carefully identified, analyzed, and grouped to focus on the resolution of systemic problems, in addition to fixing the individual issues. The issues were prioritized based on urgency of need, then assigned to specific organizations with established timelines for progress and resolution. The progress and resolution have been guided and monitored through periodic status reviews by me and my deputy. These status reviews have also included involvement of the DA Headquarters Staff and Major Commands.

Question. Would you agree with us that the main problem here is not really a computer problem—it has simply been a lack of management discipline in your ADP planning and acquisition process?

Answer. This is largely true; we had some management weaknesses. As I discussed earlier, these were primarily policy voids or a lack of management control. For example, the policy voids in providing effective life cycle management were corrected with the publication of Army Regulation 25-3. Also, to ensure this policy is clear and understood in practice, I issued "how to" pamphlets on topics like Data Management and IMA Planning.

To provide stronger management control and guidance, I revitalized the Architectural Control Committee to integrate requirements and eliminate duplication, approve Information Mission Area Modernization Plans, approve Army Capstone architectures, and adjudicate policy issues.

To maximize management visibility and control, I have reduced the thresholds for systems requiring Headquarters oversight by the Major Automated Information Systems Review Council from $50 million to $10 million.

These are some of the most significant actions taken to date. In the coming months, the Information Mission Area (IMA) management assistance teams will monitor our progress, and will help Major Commands and HQDA staffs with effective implementation of these new procedures.

Question. Describe the procedural changes you in the Pentagon have imposed on Army field activities to improve management discipline.

Answer. Acquisition approval thresholds for the MACOMs have been reduced from $50 million to $10 million. All information systems with program costs above $10 million are now reviewed at Headquarters, Department of the Army. MACOMs are now required to conduct MAISRC-like reviews of Automated Information Systems with program costs of $10 million or less. This year, ODISC4 has directed a revalidation of all Requirement Statements (formerly IMPs) to ensure only current minimum essential information requirements are being addressed.

Question. How will you verify that corrective actions have been implemented and are in fact effective?

Answer. An Information Mission Area Assistance Team (IMAAT) has been organized by ODISC4 to provide assistance to MACOM personnel in fully understanding the IMA, to assess MACOM performance in implementing IMA principles identified in AR 25-1, the Army Information Resources Management Program, and AR 25-3, Army Life Cycle Management of Information Systems, to verify implementation of corrective actions, and to recommend remedial actions as required. The first team visit was to Military Traffic Management Command during the week of 2 April 1990. Every MACOM will be visited by the IMAAT over the next two years. In addition, Army will utilize the U.S. Army Audit Agency and Army Inspector General to review and gauge the effectiveness of implementation of IMA policies and corrective actions.

COMMITMENT FROM ARMY COMMANDERS IN CHIEF

Question. Your statement indicates you have personally talked to 4-star Army field commanders about the "sizeable and timely" improvements needed in Army automation management. How do you oversee their planned ADP expenditures and what is different now than a year ago?

Answer. In the past year, ODISC4 has strengthened the Architecture Control Committee (ACC) to include MACOM membership and exercise Requirement Statement (RS) approvals. Approval thresholds for MACOMs have been reduced from $50 million to $10 million. All information systems with program costs above $10 million are now reviewed by Headquarters, Department of the Army. MACOMs are required to conduct MAISRC-like reviews of all automated information systems with program costs of $10 million or less.

BUDGET GROWTH

Question. A year ago, the Congress reduced the Army's fiscal year 1990 ADP budget request for $2.5 bilion by $.3 billion. The new budget requests $3.0 billion, an increase of $.8 billion (36 percent) from last year's appropriation.

General Hilmes, what is causing the Army to request such enormous ADP budget growth this year?

Answer. The current Army budget does not contain enormous ADP growth in FY 1991. The current budget requests a real programmatic increase of $.131 billion which is only 4.9 percent over the current FY 1990 estimate. The current FY 1990 estimate has been adjusted from the last year's submission to reflect the Congressional mark, exclude the National Foreign Intelligence Program (NFIP), adjust for changing economic indices (inflation and pay raises), and correct for technical errors. Therefore, when the current FY 1990 estimate for $2.711 billion is compared to the current FY 1991 request of $2.951 billion, we have a total increase of only $.240 billion or 8.8 percent. Of the total $.240 billion, $.108 billion is related to increases for pay raises and inflation resulting in a real programmatic increase of $.131 billion or a 4.9 percent increase over the current FY 1990 estimate. This modest increase is essential to continuing work on many of our automated systems which are on the verge of reaping productivity savings and cost avoidances distributed across the personnel, medical, financial, and logistics communities and as reaped by Defense Management Review/Army Management Review initiatives.

Question. The Congress "capped" DOD O&M funded ADP in 1990 at the appropriated amount, an increase to which requires prior Congressional approval. We understand that as a result of implementing our cap, it was discovered that Army's ADP budget to Congress has been annually understated by about $.5 billion. Please explain this anomaly.

Answer. The FY 1990 Congressional language created a de facto automation ceiling in the operation and maintenance appropriations and resulted in the Army looking more closely at our definition of automation and how we have been interpreting this definition for reporting purposes. As we evaluated our previous budget submission, we found areas of under reporting throughout the Army as a result of misinterpretation of the definition. Examples are:

Resources for personnel in support of information technology functions who are not traditionally thought of as automators were not reported in some cases. ($28 million)

Simulations, such as wargaming, battlefield simulation, etc., and automation in support of training were not consistently reported as general purpose ADP. ($110 million)

Some National Guard tactical equipment maintenance was not previously reported. ($7 million)

General automation support (such as supplies and maintenance) for fielded equipment in tactical units. These costs were included in the Army budget as the cost of doing business in TOE units—not as automation expenses. ($105 million)

Supply, depot, and other logistics automated support—such as the automated process control systems portion of material handling systems—were not entirely reported. ($116 million)

Underestimation of telecommunication cost. ($84 million)

Plus-up for economic changes such as pay raises and inflation. ($17 million)

Deletion of Life Cycle Software Engineering Centers who program post deployment software support on fielded systems where the automation is embedded in the system, i.e., weapons systems.

These costs are not reportable as an ADP cost. ($32 million)

Total technical correction is $458 million.

Question. After correcting this error, Army is still requesting about $240 million in growth in the fiscal year 1991 ADP budget. Please explain the main areas where you think growth is warranted, and why?

Answer. The $240 million increase in the FY 1991 Information Technology Systems Budget includes $108 million for inflation and pay raises, both military and civilian. The remaining $131 million of growth reflects only a 4.9 percent increase over the current FY 1990 estimate. This programmatic growth is essential to support the Army's readiness posture, including mobilization and command and control; to support joint system efforts and Defense Management Review initiatives; and to achieve productivity savings needed in a constrained resource environment.

The Reserve Component Automation System (RCAS) is a critical mobilization system for the Army. RCAS is being acquired in compliance with OMB Circular A-109 which requires a competitive demonstration of vendors' concepts. The majority of the FY 1991 RCAS program growth, $38 million Operations and Maintenance, Army National Guard (OMNG), supports this competitive demonstration. In addition, $4 million program growth in Operations and Maintenance, Army (OMA) is required to support the RCAS Source Selection Evaluation Board (SSEB) and an Independent Verification and Validation (IV&V) contract to provide assessments of the software developed during the competitive demonstration.

Another area of growth, $46 million, supports the logistics functions. The Army uses logistics automation to support critical missions, generating productivity savings and efficiencies which allow us to provide greater support to the soldier and to maintain a stronger readiness posture. Many of the logistics systems currently under development or redesign support readiness by improving our capability to develop, maintain and manage weapons system; by automating requisitioning, tracking and distribution of essential supplies, spares and repair parts; by automating procurement functions which eliminates paperwork and lead time for critical procurements; and by automating both peacetime and mobilization transportation requirements. Some of the significant initiatives requiring growth are described below:

The Strategic Logistics Programs (SLP), a Defense Management Review initiative, is expected to produce $1.2 billion in savings through FY 1997. These savings are reflected in the Army Five Year Defense Plan. The initiatives within SLP are focused towards process improvements where current processes are less than optimal and/or have potential to streamline overall logistics functions. These initiatives include: reducing order ship time; reducing materiel pipeline investment and inventories; and reducing procurement costs as a result of total asset visibility and redistribution capability. The FY 1991 resources support development of the functional description, completion of the establishment of the project management office, and initial proof of principle tests for the near term objectives of SLP.

The Standard Army Maintenance System (SAMS) will increase the Army's ability to plan, manage, and control equipment and materiel maintenance. SAMS program growth will provide preliminary concept development and system design of SAMS–3 which will improve maintenance program management capabilities at Major Command/Theater levels and provide automated day-to-day operations management capabilities for nontactical maintenance organizations.

The Department of the Army Movements Management System (DAMMS–R) will improve the Army's capability to plan, manage, and control movements of cargo, which is vital to effective mobilization as well as cost effective peace-time administration. Program growth in DAMMS–R in FY 1991 provides development of the modules which will correct critical cargo movement bottlenecks.

The Computer-Aided Acquisition and Logistic Support (CALS) program will contribute to acquisition streamlining. This initiative improves processes for the capture, storage and processing of logistics technical information required for weapon system acquisition, design, manufacture and sustainment. FY 1991 program growth funds for two competing contractors to demonstrate their concepts in accordance with the program's approved acquisition strategy. This approach is designed to lower the govenment's technical risk and to increase cost competition.

CONUS Freight Management (CFM), to be used DOD wide, to procure commercial carrier transportation services, using electronic interfaces among shippers, carriers and finance centers. FY 1991 program growth will continue development of the initial CFM capability and field to 100 CONUS sites.

Army's readiness will be enhanced by the initial operating capability (IOC) of the Strategic Deployment System (STRADS) in FY 1991. STRADS is a system of integrated capabilities that will allow the Military Traffic Management Command (MTMC) to rapidly retrieve, process, analyze and monitor movement data associated with mobilization and deployments during exercises and real crisis situations. This data includes management information of scarce transportation lift assets. This system is important to DOD in order to maintain its capability to project power through its lift capability at a time when forward deployed forces are being reduced. The program growth supports the continued development of the operational prototype and achieving IOC.

The FY 1991 program growth also supports the SOUTHCOM C3 Upgrade to communications facilities and equipment supporting the US defense contingent in Central and South America. The $15 million increase provides upgrade and expansion of the Panama Microwave System, conversion of three technical control facilities from in-house to contract operation and maintenance, continuation of the Central American Regional Communications Network for command and control support in Honduras, upgrade of the Alternate Command Center to provide SOUTHCOM essential capability to meet its expanded role in drug interdiction.

In addition, critical command and control support is provided by the Washington Area Wideband System (WAWS), a jointly funded communications system in the Washington, DC area. WAWS provides to key users highly reliable, secure communications support for national level intelligence and other vital command and control purposes. FY 1991 program growth of $2 million allows for leasing of circuitry and equipment to operate the voice and data communications systems required to provide data links between the Washington, DC area and other sites.

The Army's support of the concept of standardizing automated systems across DoD was demonstrated when the Army decided to adopt the Air Force Military Pay System. Military Pay Redesign-Joint Service Software (MPR-JSS) will bring the Army's military pay system in compliance with General Accounting Office standards and improve service to our soldiers. FY 1991 increase of $1 million provides additional personnel and travel resources during deployment and parallel usage of currently leased telecommunications and the Defense Data Network circuits for approximately six months during the conversion to JSS. Another $5 million of growth in this functional area supports the conversion of existing applications software to operate on replacement hardware being competitively procured in FY 1990 at the U.S. Army Finance and Accounting Center (USAFAC).

The combat service support functional area accounts for $7 million of the FY 1991 growth. This functional area provides ruggedized, transportable ADP hardware for use on the battlefield. Specifically this increase supports hardware maintenance needed for the Tactical Army Combat Service Support Computer System (TACCS) recently fielded to the reserve components as mandated by Congress and start up costs associated with the intitial fielding of the Corps/Theater ADP Service Center II (CTASC II).

The remaining program growth, $13 million, supports the following important automation initiatives: The Army World Wide Military Command and Control System (AWIS); the Supercomputer program; the Corps of Engineers Automation Plan (CEAP 1A); Sustaining Base Information Services (SBIS); and Project 80X. The increased resources will provide maintenance for recently fielded AWIS hardware and software, for the operations and maintenance of Supercomputer capability at the Army High Performance Research Center, University of Minnesota, and for CEAP 1A equipment sustainment cost at the congressionally mandated pilot test site. The SBIS growth is required to support the Source Selection Evaluation Board (SSEB) which is scheduled to convene in November 1990. Finally, the growth will ensure sufficient telecommunications and software support to successfully transition the contractor operated KEYSTONE system to Project 80X hardware and software.

The Army has given its FY 1991 information technology resources careful scrutiny. The $131 million of programmatic growth is warranted and represents a modest increase over FY 1990.

Question. Given the turbulence in the ADP area due to Secretary's Cheney's management reforms and Secretary Atwood's management initiatives, why is any growth appropriate?

Answer. ADP is critical for the new, leaner Army to maintain its edge in readiness, transition to conflict, and to achieve management efficiencies in peacetime. The Army has automated numerous sustainability type activities, to include pay of people, supply distribution, and personnel administration. The judicious use of ADP resources insures that appropriate, timely, and accurate information is identified and made available to meet all of our mission requirements. Without these automated systems and the efficiencies provided through improvement or replacement of outmoded systems, the readiness of the Army is directly affected. The bottom line is that the management reforms and initiatives referred to are dependent upon investment in ADP in order to achieve any potential savings. Automation used as manpower offsets are critical to an efficient and effective operating force.

There are other areas in the Army not affected by the turbulence caused by the management initiatives and are responsible for a portion of the growth that must be continued, such as the Reserve Component Automation System (RCAS), Army WWMCCS Information System (AWIS), and the Corps of Engineers Automation (CEAP).

Question. What would be the impact of holding Army to a "no real growth" ADP budget in fiscal year 1991—in other words funding inflation and nothing else?

Answer. If the Army were held to "no real growth" funding level of $2,819,389,000 in FY 1991, we would place in jeopardy the major initiatives discussed previously in response to your question regarding budget growth. With only inflation and pay raises funded, the Army would not be able to reap the productivity savings and cost avoidances generated (many of which have already been reaped by Defense Management Review Decisions) which are critical to successfully performing our mission in a rapidly changing and resource constrained environment.

WRITTEN POLICIES

Question. Your statement says "We needed a written strategy for sustaining base automation, published policies, and "how to" pamphlets to implement policy. So we did that". GAO tells us that the "how to" pamphlets are not published and are in fact very late. Is this true? How many of the 8 "how to" pamphlets are in fact published today? How many will be published by your original target deadline of April 1990? What is your current estimate of when all 8 will finally be published?

Answer. The Strategy for Sustaining Base Automation was published in October, 1989. Revised policy guidance, Life Cycle Management of Information Systems, was published as AR 25-3 in November, 1989. How-to guidance for organizations to perform Army Information Engineering (AIE) tasks are no longer being published as a separate set of handbooks. The original concept called for eight "phases" of AIE. The Army determined these were redundant with existing Life Cycle Management guidance and reduced them to three phases (Information Requirements Study, Information Requirements Study Implementation, and Information Area Analysis). This how-to guidance is contained in the revised DA PAM 25-1, Army Information Architecture. The pamphlet is currently in Army-wide staffing and scheduled for publication during 1st Qtr FY 1991.

Question. How can Army field activities effectively manage $3 billion of ADP programs without effective "how to" instructions from the Pentagon?

Answer. New Army regulations, specifically AR 25-3, Army Life Cycle Mangement of Information Systems, deliberately contains considerable "how to" guidance. Additionally, several technical pamphlets desgined to complement AR 25-3 are in various stages of preparation and all are scheduled to be fielded by 1st Qtr FY 1991.

Question. The Army has been criticized for years for failure to implement mandatory DOD regulations on "Life Cycle Management" of ADP systems. When will the Army have OSD approved LCM policies fully published, documented, and working?

Answer. AR 25-3, Army Life Cycle Management (LCM) of Information Systems, which implements OSD policy, was effective 14 November 1989. Supporting technical PAMs to AR 25-3 are:

a. DA PAM 25-LCM, outlines LCM procedures and documentation requirements for the review and approval of information systems while highlighting the MAISRC process. Completion date 4th Qtr FY 1990.

b. DA PAM 25-Acquisiton, provides guidance for acquisition of AISs. Completion date 4th Qtr FY 1990.

c. DA PAM 25-TE, provides guidance for the testing of AISs. Completion date 1st Qtr FY 1991.

d. DA PAM 25-CM provides configuration control management guidance for AISs. Completion date 4th Qtr FY 1990.

e. DA PAM 25-TD, provides implementation guidance for DOD-STD 7935A. Completion date 4th Qtr FY 1990.

Question. Explain how the Army has implemented policies on baselining ADP systems acquisiton requirements and what remains to be done?

Answer. The Army has published AR 25-3, Army Life Cycle Management (LCM) of Information Systems, Effective 15 October 1989, which establishes the Army's LCM processes, prescribes attendant policies and procedures, and assigns responsibilities for program implementation and execution for information systems. The Army regulation will be supplemented by DA Pamphlet 25-Acquisition which provides specific guidance for program managers tasked to develop information systems and obtain Information Mission Area (IMA) assets. The pamphlet provides the basic procedures to be followed in contracting for IMA assets. The acquisition pamphlet is scheduled for completion in 4th Qtr FY 1990.

Question. Explain how the Army has implemented policies on implementing DODI 7920.4 (end user computing) and what remains to be done.

Answer. The planning for end user computing is included in the Requirement Statements process (formerly IMP process) where user requirements are identified. Requirement Statements are addressed in DAP Pamphlet 25-2, IMA Planning, currently in Army-wide staffing. An initial draft of DA Pamphlet 25-EUC, End User Computing, is currently under review and will be staffed Army-wide during 4th Qtr FY 1990.

Question. Explain how the Army has implemented policies on redistributing excess ADP inventory and what remains to be done.

Answer. The Army fully participates in the DOD ADPE Redistribution Program, governed by DOD 7950.1M, September 1988, which provides for the reporting reutilization and disposition of excess automated data processing equipment. The Army program includes all government owned or leased equipment to include mainframe, mini, and micro digital, analog or hybrid computers as well as office automation equipment. The Army's program is managed by the Information Systems Software Center, Fort Belvoir, Virginia. AR 18-7, Automatic Data Processing Management Review Program, provided Army policy and guidance on the redistribution program. These documents are being updated in AR 25-FM, Facilities Management, and a supporting pamphlet which are scheduled for publication during 1st QTR FY 1991.

Question. Explain how the Army has implemented policies on establishing accurate ADP hardware and software inventories and what remains to be done.

Answer. Our hardware baseline will continue to be maintained through ARPMIS until a replacement capability is available through the property book system. ARPMIS currently identifies 90 percent of the microcomputer and 80 percent of the mini and mainframe computers in the Army inventory. The cost to upgrade property book software will be approximately $280,000. The trade-off will be a savings of $330,000 in O&M costs, and better accuracy of actual equipment on-hand. For software, the Army maintains a database of Army developed/owned system applications and simulations and operates a PC software clearinghouse. Commercial software is a durable item controlled through hand receipts. In conjunction with the property book software upgrade, the Army will emphasize cataloging of ADPE. This effort also involves working with OSD to minimize the types of data that must be reported. Based upon the minimum essential data elements and cataloging, requisite software changes will be directed for the property book system.

Question. Explain how the Army has implemented policies on establishing an AIS information model and what remains to be done.

Answer. HQDA and each Army MACOM has developed an information model which depicts the processes (activities) and the information needed to perform those activities. To implement our strategy of "top down" control, the Army information model is used to guide the development of subordinate models. The Army information model is being updated for publication in DA Pamphlet 25-1, The Army Information Architecture, which is scheduled for publication first quarter FY 1991. Additional tasks remaining include development of supporting architecture products (data, applications and geographic/technical architectures) by some MACOMs. Implementation will be monitored and controlled by the Architecture Control Committee.

Question. Explain how the Army has implemented policies on establishing formal cost/benefit and ROI procedures and what remains to be done.

Answer. AR 25-3, Army Life Cycle Management (LCM) of Information Systems, dated 15 October 1989, requires a preliminary cost estimate before Milestone 0 review. An up-to-date economic analysis (EA) is required prior to Milestone I review. Following a sufficiency review of the EA and/or preparation of an independent cost estimate by the U.S. Army Cost and Economic Analysis Center, the Army cost position is developed. The position will be used to prepare appropriate budget documents throughout the system life cycle.

Major Automated Information Systems Review Council (MAISRC) procedures require that the economic analysis be one of the major evaluation factors in determining whether the system can progress to the next phase in LCM. In January 1988, the Army published a Letter of Instruction (LOI) for Integration of Information Systems Requirements, Costing, Programming, Budgeting and Execution. The LOI was co-signed by the Assistant Secretary of the Army (Financial Management) and Director of Information Systems for C4. The LOI, distributed worldwide and presently under revision, establishes policy for the conduct of analyses accomplished in support of information systems initiatives and the development of the Army cost position. The guidance establishes a framework for consistent development and application of:

a. Cost data requirements.

b. Cost and Economic Analysis of Preposed automated information activities.

c. Cost validation and analysis of on-going activities.

d. Cost estimation and support for budget preparation, defense and execution consistent with the Army Cost Position.

e. Cost, savings, funding and benefits execution tracking.

f. Estimation of Return on Investment (ROI).

Question. Explain how the Army has implemented policies on eliminating unnecessary leased telecommunications and what remains to be done.

Answer. Army has published policy for the acquisition of telecommunications in AR 25-1, The Army Information Resources Management Program, and AR 25-3, Army Life Cycle Management of Information Systems. These regulations require that telecommunications be purchased unless a lease-purchase analysis shows leasing to be the lowest overall cost or the equipment/service is not offered for sale. The U.S. Army Commercial Communications Office conducts an Army-wide biannual review and revalidation of leased telecommunications services. The last review and revalidation was performed in 1988. The 1990 review and revalidation is currently under way. As a result of inefficiencies found by Department of Defense Inspector General and the Army Audit Agency, the 1990 procedures have been modified to require users to provide a more complete revalidation of requirements. This will allow increased efficiency in termination of unnecessary leases.

Question. Explain how the Army has implemented policies on validating costs for AIS development and what remains to be done.

Answer. The Army has established a rigorous validation process for Economic Analyses of AIS. The process varies, depending on the magnitude of cost, as follows:

For systems with total costs from inception through fielding in excess of $100 million or otherwise required to be reviewed by either a DAB or OSD Major Automated Information System Review Council (MAISRC), the Economic Analysis must be officially validated by a Major Command (independent from the organization which performs the analysis) At the same time, the U.S. Army Cost and Economic Analysis Center prepares an Independent Cost Estimate (ICE) of the system. Differences between the Economic Analysis and the ICE are reconciled and provided to OSD as the Army Cost Position, defining the validated cost for that system.

For systems with total costs from inception through fielding in excess of $10 million, the Economic Analysis must first be validated by a Major Command, then reviewed and approved by the U.S. Army Cost and Economic Analysis Center before the system is allowed to proceed through the decision process at a HQDA MAISRC. The final validated costs within the Economic Analysis become the Army cost position and define the budget for that system.

For systems with total costs less than $10 million, Department of Army has delegated approval authority to the Major Commands. It is the responsibility of the Major Command to ensure the Economic Analysis is validated, independent of the preparer, but they do so according to the Letter of Instruction, subject: Integration of Information Systems Requirements, Costing, Programming, Budgeting and Execution, dated January 1988.

Question. Explain how the Army has implemented policies on monitoring AIS development in accordance with OSD policy and what remains to be done.

Answer. The Army Major Automated Information System Review Council (MAISRC) monitors compliance with OSD and Army Life Cycle Management (LCM) policy (AR 25-3). AR 25-3 requires that the Army MAISRC monitor systems with anticipated program costs in excess of $10 million, and that MACOMs structure a MAISRC-like review for the development of systems greater than $2.5 million and less than $10 million. Monitoring AIS development also is accomplished by onsite HQDA assistance teams. These reviews are augmented by the DODIG, DAIG, USAAA, GAO and HAC S&I reviews either independently or at HQDA request. The Army has prepared two documents, a Letter of Instruction

(LOI) for Conduct of the MAISRC and the DA Pamphlet 25-LCM, Life Cycle Management Documentation and Procedures, which will provide guidance to the field on the management, oversight, review, and monitoring of AIS.

Question. Explain how the Army has implemented policies on strategic planning for AIS development and what yet remains to be done.

Answer. Using the Corrective Action Plan, which I described earlier, we systematically reviewed our planning process. A significant weakness was a lack of direction to guide software development. To fix this void, we published the Army Strategy for Sustaining Base Automation in October. It provided direction on data management, technical standards, management oversight, and emphasized standard systems over command unique solutions.

This direction is being institutionalized with the publication of a "how to" pamphlet on planning, Department of Army Pamphlet 25-2. This pamplet revitalized the planning process and strengthened the role of the planning process within the Army's Planning, Programming, Budgeting and Execution System (PPBES). It requires the Major Commands and Headquarter's staffs to prepare a modernization plan for the planning phase of the PPBES and to use this to guide resource allocation in the programming phase of the PPBES. These modernization plans are time phased, resource constrained action plans to implement each organization's goals and objectives. In the future these individual plans will be integrated and prioritized into a single plan to guide the entire IMA. An initial draft plan was used to guide the FY 1992-97 Program Objective Memorandum (POM) and it will be updated for the next POM.

Question. Explain how the Army has implemented policies on improving formal training for AIS development and what remains to be done.

Answer. AR 25-3, Army Life Cycle Management of Information Systems, establishes the Army's Life Cycle Management process, prescribes attendant policies and procedures, and assigns responsibilities for program implementation and execution for information systems. Specifically, Program Executive Officers and their supporting Program Managers are responsible for ensuring that training is an integral part of information systems development.

CORPORATE INFORMATION MANAGEMENT

Question. The new buzzword in DOD ADP is Secretary Atwood's "Corporate Information Management" initiative that we discussed earlier today. The backbone of this initiative is the creation of "common data elements" that can be shared between different organizations and their computer systems. What is the Army's plan for defining common data elements for all its ADP systems?

Answer. The policy is outlined in AR 25-9, Army Data Management and Standards Program. Procedures have been defined for standardizing data in draft DA Pam 25-9, Army Data Management and Standards Program Administrative Procedures Guide, scheduled for publication in May. The automated Army Data Dictionary became operational on April 13, 1999. All new development must be in accordance with AR 25-9.

Question. Who in the Army is working on this problem?

Answer. My office has the lead here. There are four key components. The Architecture Directorate sets policy and oversees the program. The Data Management Directorate (DMD), an element of the Information Systems Command at Fort Belvoir, is the implementing agent. There are 18 HQDA Information Class Proponents (ICPs) that are responsible for the management of data in their area. The PEOs integrate and enforce the use of data standards in developing systems.

Question. Who has not even started yet?

Answer. Of our major programs, all are addressing implementation of the data standards program. Our policy is very clear. Programs that have not undergone Milestone I must use AR 25-9. Those that have received Milestone II approval do not have to. Those programs between Milestone I and II will be determined on an individual basis. Existing systems will be required to use standard data elements as they undergo redesign.

Question. Who is officially responsible for accomplishing this?

Answer. I am. Resultant outcome, however, is dependent on the cooperation of the entire Army.

Question. What is your target date for having a set of fully common data elements developed for the first time?

Answer. We will develop a basic (core) set of standard data elements over the next year. Standard data elements will be added to the dictionary as they are developed. A full set of "common data elements" will evolve over a period of several years.

Question. Discuss how your large computer development programs will use common data elements.

Answer. Developers will follow several steps to incorporate standard data. The Army Data Dictionary (ADD) is our online repository of standard data elements. Systems developers first check the ADD to see if data elements they need have already been standardized. If so, they use this standard. If no standard exsts, the developer submits a candidate for standardization. Candidates are functionally reviewed/approved by appropriate Information Class Proponents (ICP) and technically reviewed/approved by the Army Data Encyclopedia Administrator (ADEA). Once approved they are added to the Dictionary.

Question. Provide for the record a table showing each major AIS currently under development by the Army, the extent to which it will use common data elements, and by what target date.

Answer. In order to compile complete and accurate data this table will be provided NLT September 1990.

Question. The Committee has been concerned that two large Army ADP acquisitions (SIDPER-3 and RCAS) had been proceeding separately even though they need to share common data in many instances. Please describe your common data element approach for the parallel development of these two systems.

Answer. The PM has agreed to use standard data elements in SIDPERS-3. SIDPERS-3 and RCAS are on the same sheet of music.

VERTICAL INVENTORY MANAGEMENT SYSTEM

Question. GAO recently issued a sharply critical report (GAO)/ NSIAD 90-53) indicating a recent review found: (1) $184 million of excess inventory while Army item managers were purchasing $8 million of identical items, and (2) purchasing $67 million of items that were already in the inventory as excess. Will the Army logistics ADP system modernization solve this longstanding problem?

Answer. Yes, my understanding is that the Deputy Chief of Staff for Logistics' ADP systems modernization program is aimed at solving this problem.

Question. How much is budgeted in fiscal year 1991 for Army logistics ADP systems?

Answer. The FY 1991 budgeted amounts for operations and any development or redesign efforts are $302.1 million OMA, $42.4 million OPA, $10.9 million MPA, $100.9 million AIF (Army Industrial Fund), and $1.9 million in other appropriations. This is a total of $458.2 million.

Question. What is the "total life cycle" cost estimate for all Army logistics ADP developments currently underway?

Answer. The total life cycle cost estmates, in current dollars for all Army logistics ADP systems currently in development is $3.3 billion. This breaks down to:

System Name	*Life Cycle Cost ($M)*
Computer/Aided Acquisition and Logistic Support (CALS)	617.0
DA Movement Management System-Redesign (DAMMS-R)	166.0
Integrated Procurement System (IPS)	208.4
Standard Army Maintenance System (SAMS)	218.2
Standard Army Retail Supply System (SARSS)	986.0
Standard Army Property Book System—Redesign (SPBS-R)	254.0
Unit Level Logistic System (ULLS)	421.0
Army Food Management Information System (AFMIS)	124.0
Standard Army Ammunition System (SAAS)	105.6
Transportation Coordinator Automated Command and Control Information Systems (TC ACCIS)	51.8
In Transit Visibility (ITV)	28.7
Strategic Deployment System (STRADS)	20.9
Transportation Operational Personal Property System (TOPS)	41.4
CONUS Freight Management System (CFM)	21.7
Worldwide Port System (WPS)	11.5
Army Commissary Automation System (ACAS)	33.1

[CLERK'S NOTE.—End of questions submitted for the record.]

THURSDAY, MARCH 15, 1990.

RESEARCH, DEVELOPMENT, TEST AND EVALUATION, ARMY

WITNESSES

STEPHEN K. CONVER, ASSISTANT SECRETARY OF THE ARMY FOR RESEARCH, DEVELOPMENT AND ACQUISITION

LT. GEN. DONALD S. PIHL, MILITARY DEPUTY TO THE ASSISTANT SECRETARY OF THE ARMY FOR RESEARCH, DEVELOPMENT, AND ACQUISITION

GEORGE T. SINGLEY III, DEPUTY FOR RESEARCH AND TECHNOLOGY, OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY FOR RESEARCH, DEVELOPMENT, AND ACQUISITION

BRIG. GEN. MORGAN JELLETT, PROGRAM MANAGER FOR ASAT, U.S. ARMY STRATEGIC DEFENSE COMMAND, HUNTSVILLE, AL

INTRODUCTION

Mr. MURTHA. The committee will come to order.

We want to welcome Mr. Stephen K. Conver, Assistant Secretary of the Army for Research, Development and Acquisition for his first appearance before the committee. We know he is a long-term, well-experienced person from the Congress and did an outstanding job for Congressman Bill Dickinson. We appreciate your expertise and the fact that you are here and we know you will help us solve some of these difficult problems.

General Pihl, you will be leaving us soon, and there is no one that we have found to be more cooperative, hard working, and frank with us than yourself. We appreciate your dedication to the Army and to the country and it has been a great experience dealing with you. We appreciate all your hard work and wish you well in your new job.

General PIHL. Thank you, Mr. Chairman.

Mr. MURTHA. You full statement will be included in the record. If you will summarize whatever statement you may have, we will than go to questions.

Mr. Secretary.

SUMMARY STATEMENT OF MR. CONVER

Mr. CONVER. It is a pleasure to be here before you this morning. I thank you for your kind words. I hope my background as an authorizer will not reflect badly upon the Army RDT&E procurement budget, sir.

I would like to also thank you, Mr. Chairman, for your very kind words about Don Pihl. He is leaving in June after 31 years of service and we are going to really miss Don Pihl. I have known Don for about four years and I can tell you that from my position on the

Hill, I knew Don to distinguish himself by his honest approach to doing business. Don will never give you a bad answer, and I hope to continue in that tradition in his absence, but he has very big shoes to step into. We will miss him.

FISCAL YEAR 1991 BUDGET REQUEST

Sir, just a few brief words about the Army RDT&E budget. Our request in RDT&E for the Army is $6 billion. We have tried to protect RDT&E in the face of significant cuts in Army acquisition overall and we have chosen to take the cuts from procurement rather than R&D. We are not going to eat the seed corn.

We have heard it said that the Services and the Army had lots of money in the early years, but no strategy. I would like to assert to you that in the Army, we feel like we are in the opposite position now. With the leadership of our Chief, General Vuono, and the able support of our Secretary, Mr. Stone, we feel we have good strategy. We don't have many dollars to carry that out, but I think our strategy is going to help us decide where to make the painful cuts that face us.

MODERNIZATION

The Chief has put forward six imperatives as part of his strategy, one of which is modernization. That is that area that we are going to talk about today. There are three elements that I think are important about the Army strategy insofar as that strategy pertains to acquisition.

The Army of the future is going to be a lighter Army, a smaller Army. I feel that Army has to have three central characteristics: a deployable Army, a versatile Army that is capable of performing in a wide variety of types of conflicts; and most importantly, we need to have a lethal Army, even though it is going to be lighter, and that is what we are trying to do.

In terms of our investment strategy, translating the chief's overall strategy into an investment strategy, we have made a conscious decision to protect the tech base, but in the procurement side, we have been forced, for financial reasons, to accept some near-term risks most evident in the tank and helicopter programs and we have had to focus on future systems rather than the near-term systems. We will not be doing a lot of pre-planned product improvements. We will not be doing near-term production in a lot of areas.

PROGRAM REDUCTION

As I mentioned, sir, we have taken some big acquisition cuts. Between the years 1989 and 1991, we have had to take $4 billion out of acquisition and we have done that almost exclusively from procurement.

By terminating the tank production, we save a billion dollars. The Apache program is another billion dollars. We have completed the MSE communications program, that saves another billion dollars, and the fourth billion comes out of a variety of cuts, including the helicopter. So we have made a conscious decision to cut procurement and protect R&D.

In the tech base, we have tried to build in about a two percent real growth throughout the FYDP notwithstanding that we have had to take $4 billion in cuts in our overall acquisition program. Our top priorities in R&D are the LH program, formerly known as the LHX, and ASM, the Armored Systems Modernization program, known before as the Heavy Force Modernization program.

We need to work hard to gain your support of the new helicopter and the new armored systems because, frankly, we have taken a lot of risk in these programs. The risk is certainly a military risk and the judgment is that in light of the new threat that the military risk is acceptable, but there is a significant political risk in the way we have chosen to do business that may be more threatening to the future of Army modernization. We have asked the Congress to allow us to terminate the production of current tanks and helicopters. It is always very difficult to terminate current production.

The second thing that we are asking you to do may be even more difficult, and that is under the Armored Systems Modernization program, we are asking you to approve one at a time a series of new starts, and I think new starts are a very difficult thing to try to sell in this budget environment and we understand that we will have to make a very good case to convince you that is a good idea. We intend to make that case and I hope that you will give us your support.

SUMMARY

I would like to defer detailed discussion of these programs until General Pihl speaks and let him talk about the LH program and the ASM program in greater detail. I will conclude by saying I am delighted to appear before you for the first time and I look forward to working with you for the next several years.

Mr. MURTHA. Mr. Wilson.

Mr. WILSON. A quick question.

I know this is bound to be a painful political thing, the tank line. Is that both tank lines or one tank line?

Mr. CONVER. I think that needs to be sorted out. We have made a decision to terminate tank production and we are in the middle of a very painful process of figuring out how to do that in light of the fact that we have foreign military sales on the books.

Mr. WILSON. Three or four hundred tanks to Saudi Arabia?

Mr. CONVER. Yes, sir.

Mr. WILSON. Has it been approved?

Mr. CONVER. Yes, sir.

Mr. WILSON. You can't deliver those out of a shutdown line.

Mr. CONVER. No, sir. We obviously can't shut down both plants in the near term. Unfortunately, no single plant now is capable of performing all the operations necessary to deliver a complete tank. We think the Lima, Ohio tank plant is more capable of performing the bulk of the operation.

However, there are 34 or 36 distinct machining operations that are unique to the Detroit plant, and those can only be done at the Detroit plant unless we come up with some other way to do that. Either we build ahead and stockpile a bunch of parts at Detroit or we keep that portion of the Detroit plant open. We are wrestling with that now.

Mr. Wilson. You have other prospective foreign sales also, don't you?

Mr. Conver. There is a whole list of them, but the main one, other than the Saudi and the Egyptian sale, would be that to the U.K.

There is an internal debate going on there whether they should be by a domestically produced tank, a variation of the Challenger, which is at this point a paper tank, or whether they should go into some cooperative venture with us in terms of procuring and co-producing the M-1.

Mr. Wilson. Thank you.

Mr. Murtha. General Pihl.

Summary Statement of General Pihl

General Pihl. Mr. Chairman, it is certainly a pleasure to be here. Having appeared with the Secretary and the Chief on 21 February, I am pleased to be back for my second experience before your committee.

LIGHT HELICOPTER PROGRAM

Sir, I want to make four points. The Light Helicopter program is critical for the following reasons. We believe the program, first of all, to be lethal and survivable. We need the LH, about 1,800 in number, to come into our inventory between 1997 and the year 2010 to replace the Vietnam-aged aircraft, the Cobra, the unarmed OH-58As, and Cs, at the same time to be a companion piece to the Apache, the AH-64. We don't give up the Apache as we build the LH. We will operate both vehicles side by side with one another. The LH will be substantially armed. It will carry the Hellfire and Stinger missile systems. It will have the ability to perform two functions on the battlefield—light attack armed reconnaissance and air-to-air combat.

We need it more than we do the AHIP program or the current OH-58D armed, because the armed program, while important in sufficient interim and performing very well in the Gulf, does not have the capability to fly at night, in adverse weather, and in a high, hot environment. Right now, if you look at the way it performed in the Gulf, it performed at sea level and did well. We have loaded up that aircraft to its maximum performance capability.

So the LH is the future technology that gives you the capability to perform around the world in heavy, light and special operations forces environments. It gives us the capability to detect targets in adverse weather and to kill them with a Hellfire missile system.

Mr. Murtha. What are we talking about in cost between the two programs?

General Pihl. A OH-58D Kiowa Warrior is roughly $6.2 million per helicopter on average. The light helicopter we want to bring in has a design-to-cost goal of $7.5 million per copy in 1988 constant dollars. That compares to an Apache which runs somewhere around $12 million.

Mr. Murtha. How many would you buy?

General **Pihl**. Eighteen hundred, sir, light helicopters. We originally had an objective of 2,096, but as we have drawn down our force structure, the reduction in the Army aviation force now has less numbers of units that we will put the light helicopter into.

Mr. **Murtha**. Even though the Army came to us at the end of the year and said the AHIP was essential and it became one of the top priorities, if not the top priority, you are saying now because of the changed threat, AHIP is back off the front burner and this modernized version is more effective because it can operate at higher altitude, carry more equipment?

General **Pihl**. That is correct. It starts with an integral design. The entire light helicopter has been designed from the ground up rather than taking a platform and sticking sensors and weapon systems, hanging them on. It allows you to guard against observability, so in the LH helicopter, all the weapon systems are stowed inside the airframe. They don't project out on arms and, therefore, the helicopter, close to the ground, where we fight, will not be detected, and it is very important to survivability.

Mr. **Murtha**. The new helicopter will be less detectable——

General **Pihl**. Than the OH-58D, that is correct, even though it is a slightly larger helicopter, but it is powered by the most modern engine, the T-800 engine system.

ARMED OH-58D VERSUS LIGHT HELICOPTER

Mr. **Wilson**. General, I always believe everything you say so I am not going to question you on this very sharply. However, I do have friends in Fort Worth that have some interest in this.

The great capability that the AHIP showed in the Gulf and the other things, and I guess the thing you remember more about the helicopter when you ride it is the mast mounted sight all I ask you is this—does the AHIP have capabilities along those lines that the new helicopter won't have?

General **Pihl**. Yes, sir, it does. We have, I think, put into the OH-58D or the Armed OH-58D, the Warrior, the capability to fight day and night and to fire a Hellfire missile system. That is why we have before the Congress a request to arm the OH-58D, to take it from its current observation role into the same model we built for the Gulf.

Mr. **Wilson**. But the new one won't be able to do laser designations?

General **Pihl**. It will, but it will not be as capable in a high, hot environment.

Mr. **Wilson**. No, the LH will be able to?

General **Pihl**. That is correct.

Mr. **Wilson**. Will it also be able to do the laser designation that the AHIP does?

General **Pihl**. Yes, sir, it will.

ARMORED SYSTEMS MODERNIZATION PROGRAM

Sir, the other program is the Armored Systems Modernization—ASM—program. We have a goal of bringing a family of vehicles into the Army inventory at around the turn of the century. There are six vehicles in the package we are requesting and we are looking at exploring a seventh vehicle which is the assault gun system, the armored vehicle that we feel we need to replace the M-551 Sheridan.

The Armored Systems Modernization Plan calls for four vehicles to be built on a common chassis. The four heavy vehicles will be, the replacement for the tank, Block III; the replacement for the infantry vehicle, or the Future Infantry Fighting Vehicle; the replacement for the howitzer; and a new engineer vehicle which will be a true counter-obstacle vehicle on the battlefield. That is a combined arms team of tank, infantry, artillery, and engineers that will all have the same protection level, survivability, and the ability to fight that is greater than the M-1 tank on the battlefield.

No longer do you have a situation where a combat commander would be able to take the M-1 forward, but have to leave the Bradley and the thinner-skinned vehicles one ridge line to the rear. So we are looking at maximizing commonality in order to reduce our development and operating costs and to have the economies that come in producing four kinds of vehicles off one line.

We also have two medium vehicles, one being the Line-of-Site Anti-Tank, using the kinetic energy missiles built by LTV, our overmatch missile system that has a kinetic energy rod in it that flies down range at about the same speed as a tank round and knocks the turret off an enemy tank rather than penetrating it. It is a very high-risk technology, but it is our most promising overmatch capability. We want to have an armored rearm and resupply vehicle that provides artillery bullets and tank bullets under fire, giving us a protected system on a Bradley chassis.

Sir, the final thing I would like to say is to thank you very much for your support over the past 11 years.

[The opening statement of Mr. Conver and General Pihl follows. The joint Fiscal Year 1991 Army RDT&E and Procurement Statement is printed at the end of this hearing. See page 231.]

STEPHEN K. CONVER
Assistant Secretary of the Army
(Research, Development and Acquisition)

Stephen K. Conver, the Assistant Secretary of the Army for Research, Development and Acquisition, took office on 9 March 1990.

In this capacity, Mr. Conver functions as the Army Acquisition Executive with responsibility for Research, Development, Test and Evaluation programs; procurement programs; development of acquisition policies and procedures; and implementing worldwide security assistance policies.

Mr. Conver previously served on the professional staff of the House Armed Services Committee as the principal defense advisor to Congressman Bill Dickinson (the Ranking Republican) and the twenty-one other Republican Members of the HASC.

Prior to joining the Armed Services Committee in December 1985, Mr. Conver served for four years on the staff of the Secretary of the Air Force as Deputy Assistant Secretary (Programs and Budget). In this position, he was responsible for overseeing the development, approval and execution of the Service budget.

Between 1975 and 1981, Mr. Conver held several positions with the U. S. Nuclear Regulatory Commission, beginning as an operations analyst and progressing to Chief of Analysis and Planning for the agency.

After receiving his Bachelor of Science Degree from the U. S. Air Force Academy in 1966, Mr. Conver served for nine years as a commissioned officer in the Air Force. He earned a Master's Degree in Operations Research from Ohio State University in 1970. Mr. Conver's military experience covered a broad range of subjects, including long-range planning studies in support of advanced weapons acquisitions, technical analysis of Soviet weapon systems, and analysis of U. S. strategic force structure.

Mr. Conver was born in Memphis, Tennessee and grew up in Cincinnati, Ohio. He presently resides in Great Falls, Virginia with his wife Nan and his sons Brad and Andy. His hobbies include running, golf and youth basketball.

STATEMENT OF
MR. STEPHEN K. CONVER
ASSISTANT SECRETARY OF THE ARMY FOR RESEARCH, DEVELOPMENT AND ACQUISITION
AND
GENERAL DONALD S. PIHL
MILITARY DEPUTY TO THE ASSISTANT SECRETARY OF THE ARMY FOR RESEARCH, DEVELOPMENT AND ACQUISITION

Mr. Chairman, members of the committee; it is a privilege for us to appear before you to present the Fiscal Year 1991 budget request for the Army's Research, Development, Test and Evaluation Program. With me today are Lieutenant General Don Pihl, my Military Deputy, and Mr. George Singley, my Deputy for Research and Technology.

Our RDT&E budget request for Fiscal Year 1991 is $6.0 billion. This request represents a commitment to protect a vigorous R & D budget in a time of reduced resources. This commitment is one of the tenets of our current thinking on how to maintain the Army as a viable deterrent, capable of fighting and winning if called on to do so. Staying with that thought, I believe it appropriate to begin my remarks by explaining a little about our current thinking and how it differs from the recent past.

As you know, the size and shape of the Army is determined based on evaluation of strategic environment, the national military strategy, our doctrine and available resources. What has changed that requires us to rethink our modernization plans are the threat realities, perceptions and ambiguities, which are components of the strategic environment, and available resources. There can be little doubt that the world perceives a greatly reduced Soviet threat. In this environment it would be naive not to anticipate a long term decline in available resources. Therefore, we have undertaken to reshape our modernization efforts to ensure we structure an Army for the mid 1990s and beyond that will meet the requirements of the national military strategy within the limits of those resources we anticipate being available.

As discussed in the Army Posture Statement provided you by the Secretary and the Chief of Staff and "Equipping the U.S. Army", which I have provided you today, the Army has developed six imperatives. One of these is the need for continued modernization. In attempting to focus these imperatives three factors have been considered. These are: historical lessons, particularly Korea and the so-called post Vietnam "hollow Army"; capabilities required to support the national objectives; and the threat, both the perceived decrease in the Soviet threat and the increasing third world contingency threat. This review has convinced us that our future Army must possess three essential qualities -- it must be deployable, it must be versatile, and it must be lethal. In the RDA arena we have accepted four principles which will guide our decisions. First, our weapons systems must possess lethality and survivability at least competitive with the threat. Second, we must maintain a strong technology base. Third, we must develop and maintain essential warfighting capabilities to support the full range of possibilities under the national military strategy which dictates having capable heavy, light and special operating forces. Fourth, and finally we will concentrate our investment on future systems and accept some near term risk. Translated to action, this means we will protect our key future modernization systems such as LH and Armored Systems Modernization programs; we will terminate some current major weapons systems rather than stretch them out; and we will avoid substantial investment in product improvements and modifications in favor of investment in new technologies. In our new developments we will reduce, if not eliminate redundancy in capabilities, and we will, in some cases develop tech data packages and defer production of the system. Where we do proceed to production we may prove out the production line and then suspend production, as we intend to do with the M1A2. When full production is warranted and affordable we will field only to the level required for deterrence.

Thus, in the adjusted program we are presenting you will see: a strong investment in the tech base; emphasis on new technology armor, antiarmor and aviation systems; improved intelligence systems and sensors; advanced aerial and air defense capabilities; and emphasis on replacing aged tactical transport systems.

We want to emphasize that our strategy focuses on long term solutions which accept some short and mid-term risk.

Mr. Chairman, at this time I would like to introduce General Pihl who will address the specifics of our major systems developments by functional areas.

LTG Donald S. Pihl

The dramatic changes which have occurred in the world since I testified before this committee last year, coupled with the resultant reordering of our national priorities, have caused us to review our modernization plans and, in some cases, make significant adjustments. First and foremost we have, despite enormous pressure for budget reductions, successfully sustained our budget commitment to our key research and development programs. In fact, we have actually provided some ($5.4B in FY90 to $6.0B in FY91) real growth in the RDTE account. We did in fact terminate a number of programs to enable us to invest for the future.

Let me now address some of the specific actions we have taken and those we plan to take on some of our major systems. The most crucial area of our modernization comes in the Armor/Antiarmor arena. This aspect of our modernization crosses several functional areas and will be my first topic; I will follow with Aviation, Air Defense, Fire Support, Deep Attack and Tactical Wheeled Vehicles.

(Armor/Anti-Armor Chart)

The predominant weapons of the close battle are the tank, the infantry fighting vehicle and the attack helicopter. It is these areas where the most significant adjustments have been made. Implementation of our revised strategy for modernization results in completion of M1 procurement with the FY91 buy. We will procure 163 M1A1 tanks and prove out the M1A2 production line with procurement of 62 additional tanks in this enhanced configuration. This will result in a total production run for the Abrams of 7,789 tanks, a quantity we believe to be sufficient in view of recent world events. The last tank from the FY91 buy will be delivered in FY93 and at that time we will suspend tank production until we begin procuring the Block III tank.

The Block III tank improvements envisioned are a new gun, countermeasure technologies, autoloader, advanced power pack, improved track and suspension, weight reduction (from 70 tons to a 55 ton goal) and introduction of modular armor to improve survivability.

The Kinetic Energy Missile on a Bradley chassis is the Line of Sight Antitank or LOSAT dedicated antitank weapon. It will replace the Improved TOW vehicle which is a M113 carrier with a TOW pod that preceded Bradley and is still in the dedicated antitank companies of the heavy force. I might add at this point that the seven systems on this chart which have their planned procurement quantities highlighted are all part of our Armored Systems Modernization Plan.

For the past decade the fielding of the Bradley Fighting Vehicle has lagged behind the fielding of the M1 tank. Thus, to implement our plan of a well-rounded fully modernized, albeit smaller, force the Army will continue to produce the survivability upgraded Bradley with product improved TOW 2A and TOW 2B. This is essential to maintain the kinetic energy and chemical energy mix of tank killing systems in the heavy force and to close the fielding gap between the Abrams and Bradley. Ultimately we will follow the Bradley with the Future Infantry Fighting Vehicle (FIFV). A wide range of alternatives is possible for an FIFV. The reason we have included it in Package 1 of our Armored Systems Modernization Plan is to utilize the common heavy chassis and field a future infantry vehicle that can fight with the Block III tank.

As in the case of M1 tank, FY91 will also be the last year of procurement for the AH-64 Apache helicopter. This will result in a total production run of 807 aircraft. While this is less than we had planned to procure just two years ago, it is still well above the original procurement goal of 675, and is a quantity that we feel is sufficient for our future requirements. Additionally, when we couple Apache with the LH, currently in development, we will have a much more capable, well-rounded aviation force. I will reserve further comment on aviation systems until I discuss that functional area.

While these current adjustments to our tank, infantry, and aviation capabilities are ongoing, we are also continuing to develop a key system for the light forces and dismounted soldiers.

The Antiarmor Weapon System-Medium (AAWS-M) is a key force multiplier. AAWS-M is the missile which replaces the outdated DRAGON and will kill a modern tank by employing a top attack kill mechanism. At less than 45 pounds, this single-man employable system is invaluable to our light forces and will also be used to thicken the heavy forces since it will be with Bradley crews for use in built-up areas, woods, and close terrain. The AAWS-M is capable of launch from an enclosure and will solve the Army's requirement for military operations in urban terrain (MOUT). We have selected a system using fire and forget technology and moved into full scale engineering development last year. This system, when deployed, will give our infantrymen a level of both lethality and survivability never before enjoyed by any dismounted soldier engaged in an anti-tank role.

I will comment on the artillery systems when I discuss the Fire Support functional area.

The M9 Armored Combat Earthmover (ACE) is a highly mobile, armored earthmoving vehicle that can dig, doze, haul and scrape. It is fast enough to keep pace with modern tanks on the battlefield and offers the operator protection from small arms fire, artillery fragmentation and NBC agents. This system will be followed by another member of our Armored Systems Modernization Package I, the Combat Mobility Vehicle (CMV). In order for the Block III tank to preserve and exploit its offensive capability, the combat commander requires a true counter-obstacle vehicle. The primary task of the CMV will be to defeat complex obstacle systems. The CMV will also be performing a variety of additional tasks such as creating combat roads and trails, digging survivability positions and creating antitank ditches. The CMV will be required to operate in the same lethal environment as the tank and the Future Infantry Fighting Vehicle.

Let me now briefly address the other functional areas I mentioned earlier.

(Aviation Chart)

The Army Aviation Modernization Plan encompasses the entire RDTE and Procurement aviation mission area to include all aircraft, their associated systems and repair parts. One of the major premises in developing this plan has been that funding will continue to be constrained so that older aircraft need to be retired with a concurrent force structure reduction.

Specifically, the revised Army Aviation Modernization Plan will: (1) terminate production of the AH-64 Apache after 1991, resulting in a total procurement of 807 aircraft, (2) continue procurement of the UH-60 Blackhawk for a planned total of 2253 aircraft; (3) complete the modification of the CH-47D Chinook; (4) procure MH-60K Special Operations Aircraft; (5) provide for minimum safety and mission essential modifications for the AH-64 and UH-60; (6) fully fund the development of the new vitally needed Scout/Light Attack helicopter (LH); (7) retire aging helicopters and; (8) fund those programs necessary to support and sustain all aviation programs.

A major objective in balancing the six major aircraft category capabilities in the AAMP - attack, reconnaissance, lift, cargo, intelligence and electronic warfare, and special operations aviation - is to ensure that every weapon system procured achieves its full potential in combat. The synergy achieved by an aviation force fully integrated with the other members of the combined arms team is readily apparent in the capacity of attack helicopters to rapidly concentrate combat power.

A quick-reacting attack helicopter fleet can disrupt and destroy moving armored columns and other high value targets wherever an enemy is attacking. The AH-64 Apache has been designed to provide this capability as a principal anti-armor weapon.

The Apache is highly mobile and capable of providing direct and indirect aerial fire during day, night, and limited visibility operations. The main armament of the Apache is the highly lethal and accurate Hellfire missile. Various combinations of Hellfire, Hydra-70 rockets, and 30MM ammunition may be employed depending upon mission requirements. As of 1 January 1990, 544 Apaches have been delivered and 439 fielded. FY91 R&D money continues the Apache Longbow (formerly the Airborne Adverse Weather Weapon System (AAWWS)), which is being developed to provide a fire-and-forget Hellfire anti-armor missile. This will allow the Apache to remain hidden from anti-aircraft fire shortly after firing the missile. There are 18 AH-64 Attack Battalions deployed and ready for combat including 5 battalions deployed to Europe.

Scout helicopters perform the vital reconnaissance mission as well as intelligence, surveillance and target acquisition and designation. The Kiowa Warrior (formerly the Army Helicopter Improvement Program (AHIP)), or OH-58D, gives the Army a scout helicopter employing a thermal imaging system, laser range finder/designator and high power television incorporated into a mast mounted sight that provides superior detectability and survivability. Operating day or night under hot and adverse weather conditions, the Kiowa Warrior provides command and control, target acquisition and target designation. Due to affordability, the Kiowa Warrior is not included in the budget. The program stops at 243 of the 507 required.

LH is the centerpiece of Army Aviation and the Army's number one priority system in research and development. It is absolutely critical to the future of the Army, particularly when one considers its role as a force multiplier and as an antiarmor system. LH will replace the AH-1, OH-6, and OH-58 light helicopter fleet and complement the AH-64. The light fleet is approaching obsolescence and will be unable to meet the possible threat of the mid-1990's and beyond. Missions of LH include armed reconnaissance and light attack with an inherent air-to-air capability. The LH will provide a highly reliable, easily maintained weapons system with the lethality and survivability necessary for deployment on the battlefield of the future. LH will have enhanced combat capability through the use of advanced technologies in the Mission Equipment Package (MEP), airframe and engines. Enhancements in target acquisition, night pilotage and navigation systems expand the warfighting capability of Army aviation into the hours of darkness and adverse weather.

LH is a key conventional force initiative that will enhance the conventional warfighting capability of the Army while remaining within constrained force structure and funding projections.

(Air Defense Chart)

The Army has the world's best tank and the world's best fighting vehicle in the forward area. However, they are currently being defended from the air threat by a 1968 vintage air defense gun. Recognizing that the multiple air threat to the forward area cannot be countered with a single weapon system, the Secretary of Defense approved the Forward Area Air Defense System (FAADS) concept on 8 January 1986. FAADS is a "system of systems" comprised of Line-of-Sight Forward Heavy, Non-Line-of-Sight, Line-of-Sight Rear, Combined Arms Initiatives, and Command, Control and Intelligence.

Line-of-Sight Forward Heavy (LOS-F-H) maneuvers with the combined arms team. It uses laser beam guided missiles mounted on a Bradley chassis to provide defense against helicopters, fixed wing and other aircraft that are in line of sight.

Non-Line-of-Sight provides the unique capability of engaging helicopters and armor that are masked by terrain or are beyond the range of line of sight systems. The key system feature is a fiber optic cable which allows the gunner to guide the missile and view what the missile seeker sees as it flies to the target.

Line-of-Sight Rear uses the proven Stinger missile pedestal mounted on a HMMWV to engage fixed wing aircraft that are attacking our logistics points and command points in the rear of the forward area or are transiting to the rear.

The Combined Arms Initiative provides "self-help" air defense for helicopters, tanks, and the Bradley. Air-to-Air Stinger is being incorporated on helicopters, tank ammo is being enhanced for air defense application and the Bradley reticule sight is being improved to enhance air defense capability. Each of these FAAD component systems will be very effective on an individual basis and will serve to complement each other. However, the "glue" that holds the FAAD system together is the Command, Control and Intelligence component. This component is made up of a series of ground and aerial sensors and communication equipment that serve to pull FAADS together into truly a "system of systems". With the fielding of FAADS, our ground forces will be defended from the air threat by the world's best air defense system.

(Fire Support Chart)

The 1988 Defense Science Board (DSB) Study on Countering Soviet Fire Support Systems concluded that systems designed to counter threat fire support must be fielded much more rapidly, and in significantly greater quantity, if friendly forces are to survive the initial preparation fires of an attack.

Our Fire Support Master Plan is consistent with the recommendations of the DSB and addresses cannon, rocket and missile systems used to perform three principle missions: close support for maneuver units; counterfire against threat indirect fire systems; and deep fires against high value targets. The modernization trend in this functional area is toward individual weapon systems operating autonomously with position/navigation systems and on-board fire control; smart munitions permitting lethal attack of point targets; and significantly improved target acquisition, command and control, and logistical support.

The Army's new lightweight 105mm howitzer, the M119, is scheduled for initial fielding in December 1989. The M119 will add needed firepower and improved range and reliability to rapidly deployable light infantry, airborne and air assault light divisions.

In the close support role the M109 Self-Propelled Howitzer provides the primary indirect fire support to the maneuver brigades of armored and mechanized infantry divisions. The M109 Howitzer Improvement Program (HIP) will have the capability of autonomous operations with its on-board fire control system and positioning/navigation system, with significantly improved survivability, responsiveness and reliability.

To enhance this system's counterfire capability a new munition is being developed. The Sense and Destroy Armor (SADARM) is a relatively low cost sensing munition designed to detect and destroy lightly armored vehicles, primarily self-propelled artillery. After launch the submunition is dispensed over the target area and searches for stationary or slow moving armored vehicles using a combination millimeter wave/infrared, dual mode sensor. Once a target is detected, SADARM fires an explosively formed penetrator which, traveling at an extremely high velocity, perforates the top of the target. This munition remains in development. SADARM is also being developed for the MLRS.

While the Army continues to improve the M109 self-propelled howitzer under the Howitzer Improvement Program (HIP) and continues to field the Multiple Launch Rocket System (MLRS) with newer rounds coming, such as Search and Destroy Armor (SADARM) and Terminally Guided Weapons (TGW), the need for a modern howitzer replacement is self-evident. The AFAS will apply advanced projectile propulsion, either liquid propellant or unicharge. Also envisioned are automated ammo handling and firing, advanced fire control/battle management, signature reduction technologies and increased protection. These will be demonstrated in an Advanced Technology Transition Demonstrator (ATTD) in order to achieve greater range, greater survivability, reduced crew, increased on board ammo supply, autonomous operations, and 3-4 times the rate of fire over the HIP.

The Multiple Launch Rocket System (MLRS) is a system of multiple fire, free flight rockets with Dual Purpose Improved Conventional Munitions (DPICM) warheads. MLRS supplements cannon artillery fires by delivering large volumes of firepower in a short time against critical, time-sensitive targets. System growth is planned by adding a Terminal Guidance Warhead (TGW), a chemical warhead, Sense and Destroy Armor (SADARM) and Army Tactical Missile System (ATACMS), which I will address later.

Finally, the Future Armored Resupply Vehicle-Ammunition (FARV-A) is the ammunition resupply vehicle to replace the FAASV. It will be complementary to the AFAS. There will be one FARV-A for each AFAS and the fielding of the two systems will be simultaneous. The FARV-A will provide automatic rearm capability for the AFAS negating the requirement for the crew to dismount during reload operations. This concept will allow for rapid rearm, will be less manpower intensive, and will increase the survivability of the Army's future direct support artillery system.

(Deep Attack Chart)

Currently our forces do not have the full capabilities necessary to execute deep operations to the extent envisioned by our Airland Battle doctrine. Joint programs with the Air Force provide for many of the deep operations requirements, and we are also developing capabilities on our own to better execute deep operations.

The Army and Air Force are developing the Joint Surveillance Target Attack Radar System (JSTARS) which will enable commanders to see more than 100 kilometers deep into the enemy's force array. JSTARS is a battle management and target attack control system that will detect, track and assist in attacking moving and fixed tank-sized targets. The Army is developing the Ground Station Module while the Air Force provides the airborne platform, radar and data links.

As mentioned earlier, ATACMS is a conventional semi-ballistic missile that will be fired from the existing MLRS launcher; each launcher will carry two ATACMS missiles, each with 1000 Antipersonnel Antimateriel (APAM) bomblets. It is designed to engage high priority land targets at ranges beyond the capability of cannons, rockets and the Lance missile system. Its mission is to interdict, delay, disrupt and destroy the second echelon assault forces, command and control elements, and logistic support units.

In the non-strategic nuclear arena the Follow-on to Lance (FOTL) is a replacement for the aging Lance missile system. FOTL will meet the corps and theater commander's requirements for delivery of nuclear fires against high priority targets. Research and development funds in FY91 will initiate a Full Scale Engineering Development contract.

(Tactical Wheeled Vehicle Chart)

Combat Service Support includes some of the least visible, yet crucially important, products of the RDA effort to equip our soldiers with the equipment and systems needed to defeat the threat. These items include our tactical wheeled vehicles, which are absolutely essential.

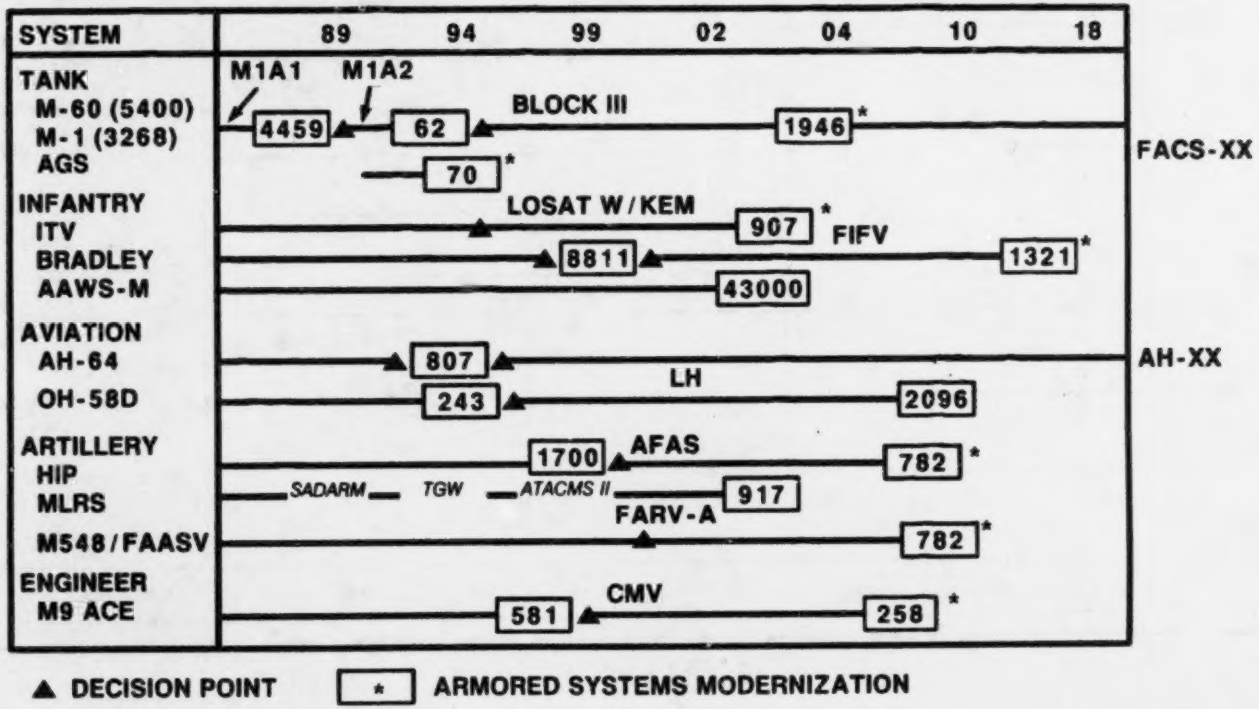
We are continuing to procure and field the very successful High Mobility Multipurpose Wheeled Vehicle, HMMWV. This lightweight, highly mobile, diesel powered, 5/4 ton vehicle has been well received in the field and will continue to be the backbone of the light vehicle fleet for some time. The Army already has Congressional authorization for an additional multiyear contract for more HMMWVs and we are looking into procuring additional vehicles well into the 1990s.

The Army is proceeding with a new Family of Medium Tactical Vehicles (FMTV) to replace the aging 2.5 Ton vehicles and help correct existing shortfalls in the 5 Ton fleet. The FMTV will have multiple body styles and should be shorter, lighter, more fuel efficient, and more mobile with reduced ownership costs. We will capitalize on state-of-the-art truck design for the FMTV.

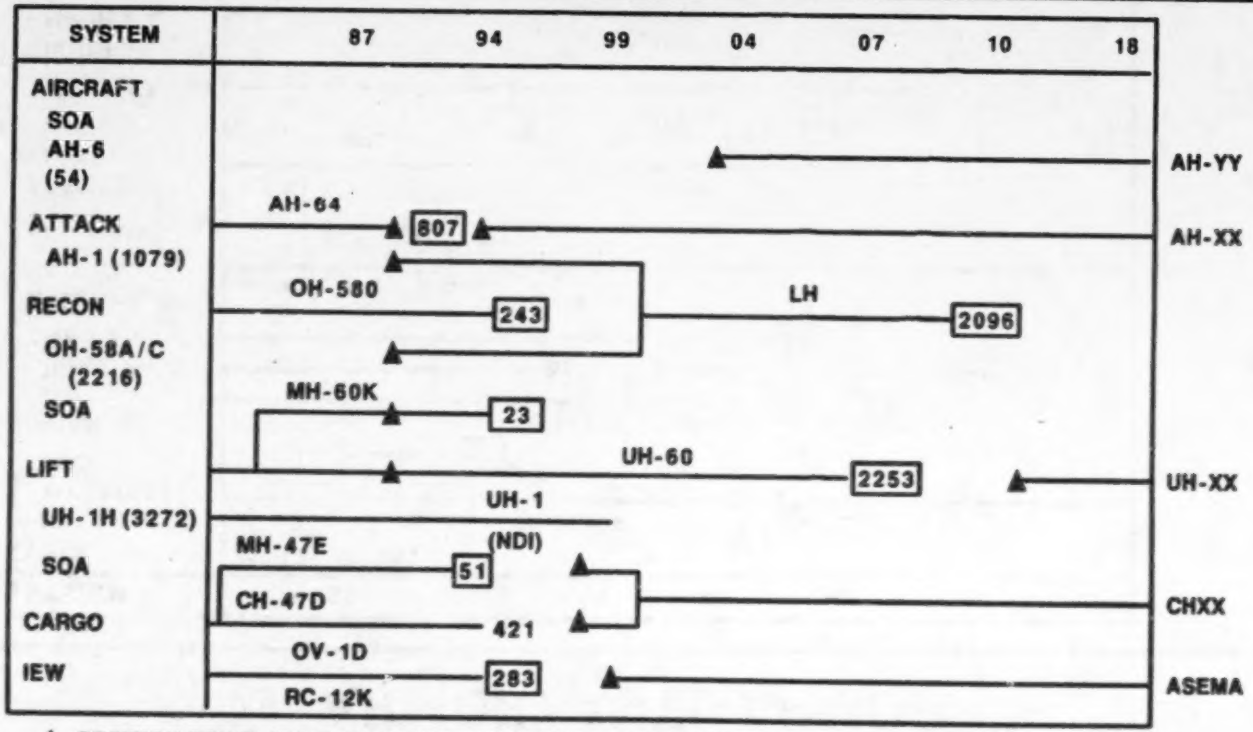
The Palletized Loading System (PLS) is a Non Developmental Item (NDI) truck which will feature a self load/unload capability heavy truck and companion trailer for use in the Corps Ammunition Distribution System. We expect PLS to improve ammunition transportation and handling efficiency while requiring less personnel, reduced MHE and releasing existing heavy truck assets for other essential missions.

In closing let me say that I am thankful to the four oversight Committees, and in fact the entire Congress, for the support which has been provided to our modernization program over the past decade. This year our budget request contains what we consider to be the minimum funds essential to redressing our insufficiencies and developing the capabilities essential to the defense of our nation. With your help and support, we will provide our Army with what is needed for it to continue to serve as a viable deterrent and to be ready should it be called upon to protect our Nation's vital interests. I ask your support in sustaining this level of funding.

ARMOR / ANTI-ARMOR

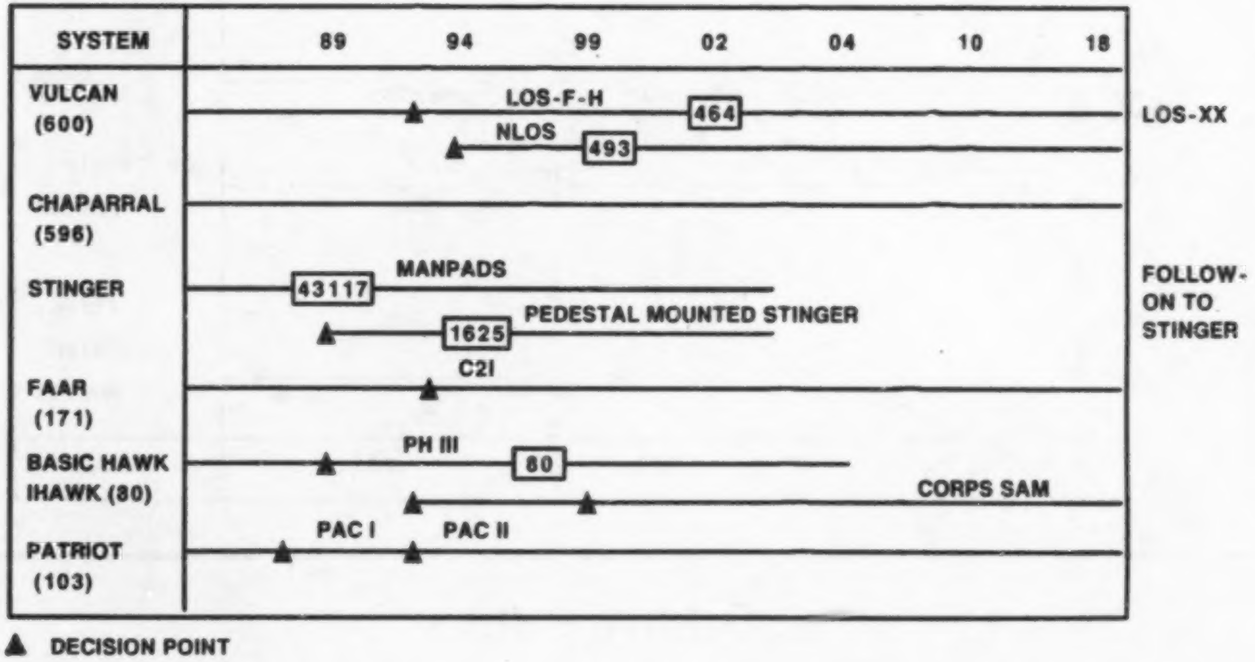


AVIATION

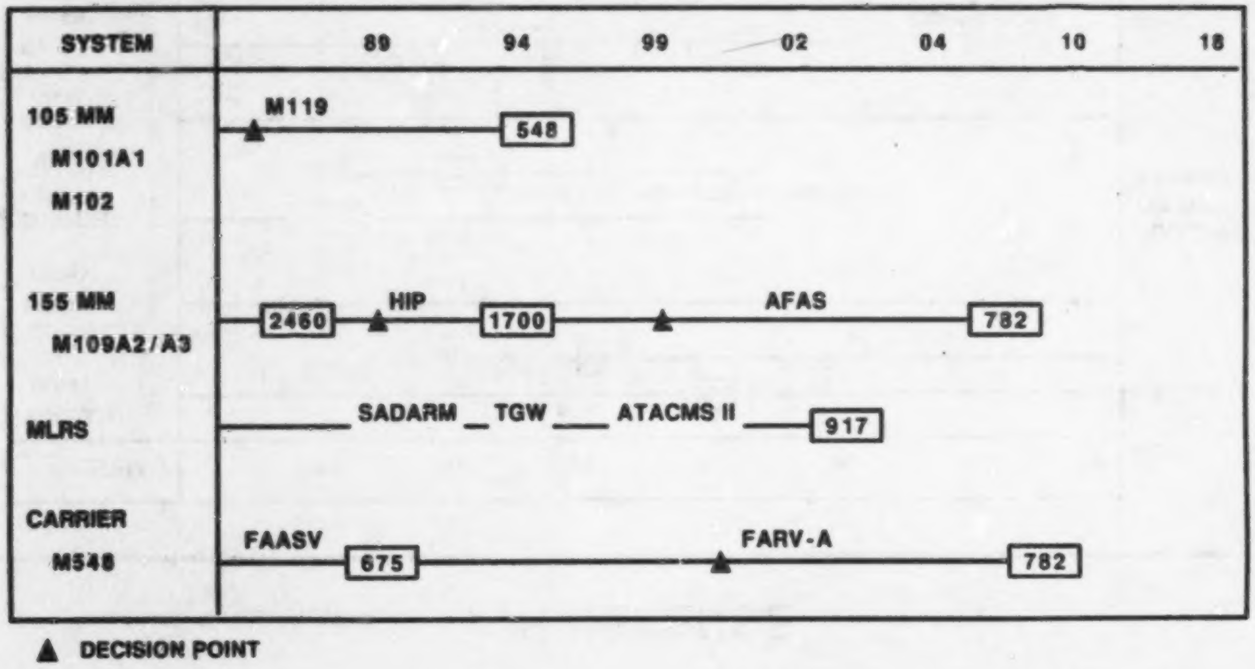


▲ DECISION POINT: MULTI STAGE IMPROVEMENT PROGRAM (MSIP) OR NEW AIRCRAFT

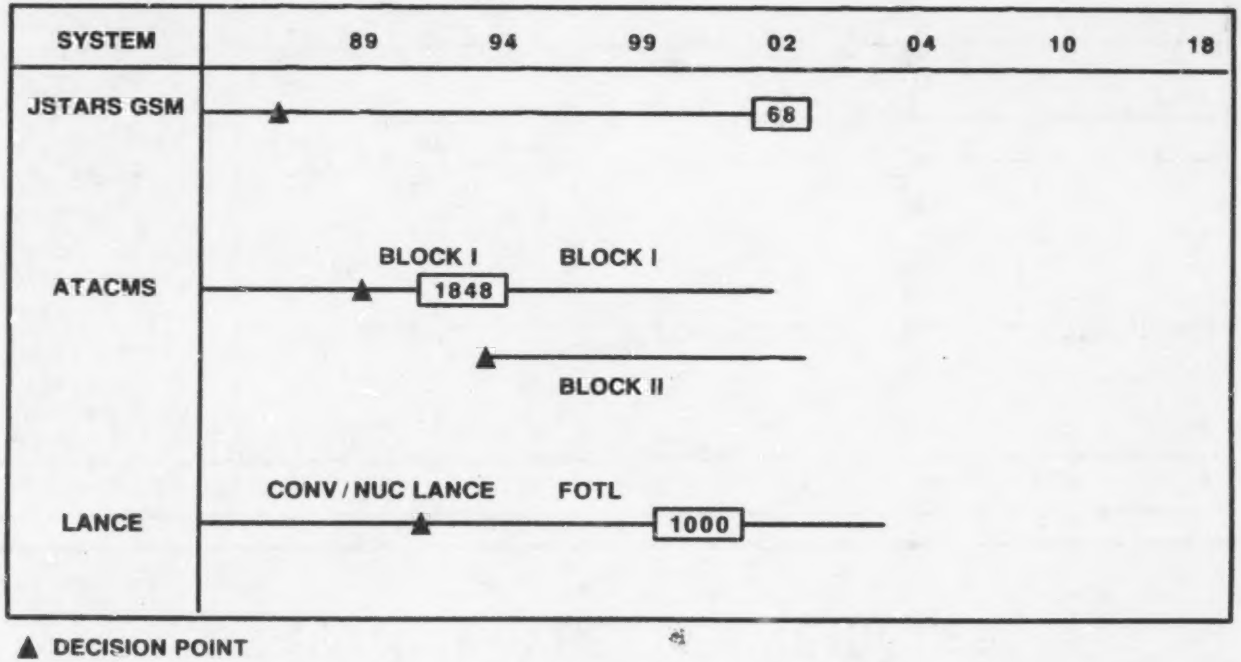
AIR DEFENSE


SYSTEM
89
94
99
02
04
10
18
VULCAN (600)
LOS-F-H
464
LOS-XX
NLOS
493
CHAPARRAL (596)
STINGER
43117
MANPADS
FOLLOW-ON TO STINGER
1625
PEDESTAL MOUNTED STINGER
FAAR (171)
C2I
BASIC HAWK IHAWK (80)
PH III
80
CORPS SAM
PATRIOT (103)
PAC I
PAC II
▲ DECISION POINT

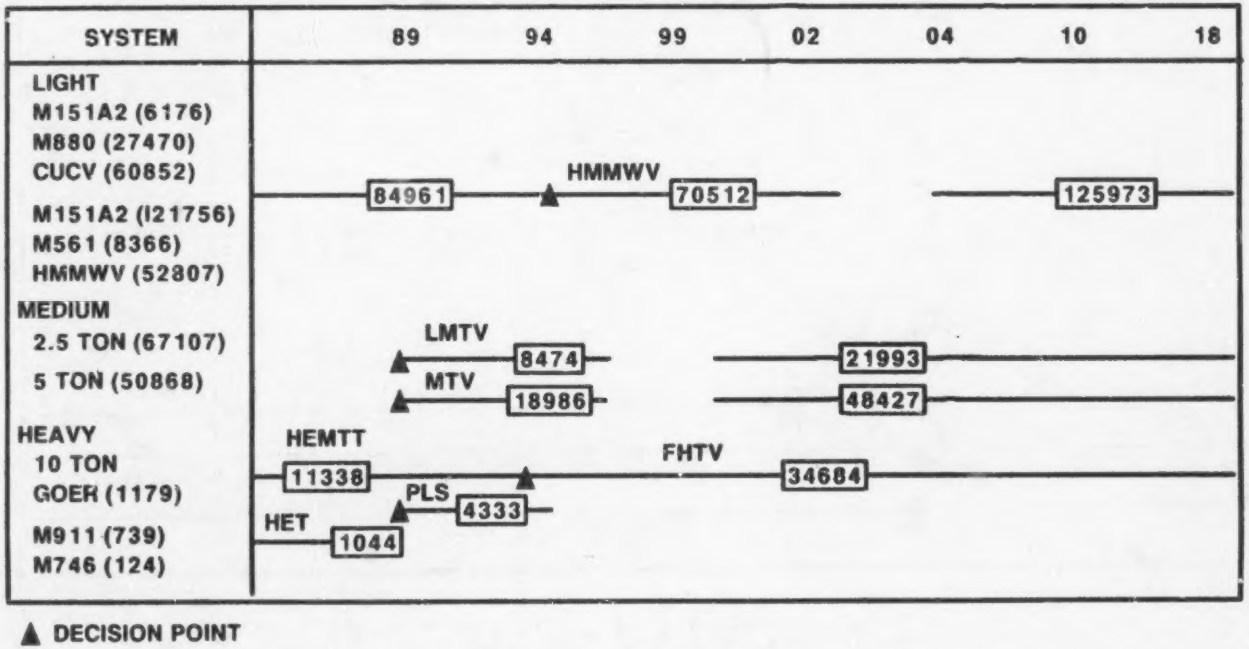
FIRE SUPPORT



DEEP ATTACK


SYSTEM
89
94
99
02
04
10
18
JSTARS GSM
68
ATACMS
BLOCK I
1848
BLOCK I
BLOCK II
LANCE
CONV / NUC LANCE
FOTL
1000
▲ DECISION POINT

TACTICAL WHEELED VEHICLES



Mr. **Conver**. If I could, I would like to introduce George Singley, who would like to talk to you about the Army technology base programs.

Mr. **Murtha**. Mr. Singley.

SUMMARY STATEMENT OF MR. SINGLEY III

Mr. **Singley**. I have a prepared statement I would like to enter into the record.

This past year we have made, I think, some very significant progress within the Army in terms of protecting the technology base. This past year, we have instituted strategy for the technology base so that we don't eat our seed corn and mortgage our future. We have established an objective of two percent real growth in terms of our basic and applied research, our 6.1 and 6.2 accounts.

UNIVERSITY RESEARCH

Furthermore, we have arrested a decline that had occurred in recent years in terms of our principal investigator program. These are individual researchers that we funded in the universities. That now amounts to 21 percent of our fiscal year 1991 program. That program alone supports 173 universities across the Nation in 46 States, over 550 researchers and 700 graduate students per year.

We have also identified in our Army Technology Base Master Plan those technology products that are needed to support our resource constrained force modernization plans such as the Armored Systems Modernization Plan and the Aviation Mod Plan.

We invested 25 percent of all our technolgoy base funds in key emerging technologies and in support of the DOD critical technologies plan which will be provided to the Congress this year. There is a very close linkage between our key emerging technologies and that plan. This past year we initiated a program called the Advanced Technology Transition Demonstrations. This initiative focuses a large amount of our 6.3A funding on high-priority, high payoff technology demonstrations.

When you look at the Armored Systems Mod Plan in the President's budget for fiscal year 1991, you will see some of these ATTDs. These are essential to demonstrating the technology that will be needed for our future armored systems, and we would request your support for that. Approximately 40 percent of our 6.3A program is going into 13 Advanced Technology Transition Demonstrations which were advocated by the Defense Science Board and the Army Science Board.

Another point I would like to make is that we have funded the Army's 13 key emerging technologies so we can avoid technological surprise and we can maintain our technological supremacy. Particular areas that we have funded include electric guns.

With the support of the Congress last year and an increase of $10 million in our fiscal year 1990 budget, we have initiated an aggressive competitive program which already is bearing fruit in the area of electrothermal chemical gun propulsion. Last month we announced with DARPA the setting of a world record in terms of electromagnetic rail gun technology where we have achieved an eight megajoule muzzel energy level with a ninety-millimeter gun at the University of Texas, which happens to be one of our Centers of Excellence.

Another effort which is very important to us is that we will transition the Army/DARPA/Marine Corps Armor/Anti-Armor program at the end of this year to the Army lead. I would like to assure the committee that we intend to preserve the basic nature and content of that program so that we maintain this fruitful intellectual competition between the industry that we have now been able to build over the last four years of investment and our government labs in this area. It has been a very exciting year for our dual-use technologies efforts.

Last year we had only about 15 cooperative R&D agreements under the auspices of the Stevenson-Wilder Act. We now have over 40 CECOM and the Electronics Technology and Devices Laboratory at Fort Monmouth recently signed a very encouraging agreement with the New Jersey Commission on Science and Technology. That agreement is part of ETDL's Open Laboratory Program and will open up our government labs at Fort Monmouth to researchers from industry and academia to work with our government scientists and engineers on technologies that have military application, and will contribute to maintaining our international competitiveness. That program alone will open up our Fort Monmouth labs to approximately 180 professors, scientists and engineers to work part-time and full-time on such programs.

Finally, I would like to say that we have published, as I stated, the Army's Technology Base Master Plan, our roadmap to the future. It is a unique document across the Services I think when you see the DOD investment strategy, you will see a remarkable similarity between our strategy laid out and that document. It was published in April of 1989. We now have the National Academy of Sciences reviewing our key emerging technologies to make sure that they are in fact current.

The other point I would like to make on technology transfer, because it was brought up last year in our testimony, is that we have awarded the Army High-Performance Computing Research Center to the University of Minnesota. Minnesota is also teamed with Purdue and with two historically black colleges or universities institutions, Howard University and Jackson State. The reason I mention this is that Howard University receives approximately 14 percent of all the research dollars in that program. The final point is that we view the technology base as absolutely essential to maintaining our future and achieving the vision of our future Army. After all, technology can be viewed as a major contributor to deterrence.

Thank you.

[The statement of Mr. Singley follows:]

STATEMENT OF
MR. GEORGE T. SINGLEY III
DEPUTY FOR RESEARCH AND TECHNOLOGY
OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY FOR RESEARCH, DEVELOPMENT AND ACQUISITION

As tensions ease in Europe and the likelihood of conflict there declines, we must not lose sight of the fact that the Soviet Union remains a most formidable conventional land power. Regional conflict around the globe is on the rise, inherently unstable, unpredictable, and dominated by conventional land warfare weaponry. In the 1990's, third world conventional weaponry will have greater lethality and will continue to expand in numbers. Our conventional land forces must be equipped with weapons that overmatch this expanding array of increasingly capable threats. Our forces must be versatile, deployable, lethal and exploit technological opportunities.

Rising global economic and technological competition, coupled with a decline in U.S. defense industry long-term R&D investment, make it imperative that we strengthen the defense technology base. The Army has made major improvements to this end by identifying and protecting those research and technology programs holding the greatest promise for long-term warfighting capabilities. In April of last year we published the Army Technology Base Master Plan. We have been active participants in the preparation of the DoD Critical Technologies Plan to be submitted to Congress this month.

(CHART 1 - Army Technology Base)

Our FY91 budget request has protected research. By protecting basic and applied research, this budget request has arrested the recent decline in funding for university researchers funded by our principal investigator program. This budget request commits approximately 25 percent of our $1.25 billion dollar technology base request to key emerging technologies. In order to reduce the time from concept to development of future weapon systems, the Army has focussed approximately 40 percent of our 6.3A on 13 Advanced Technology Transition Demonstrations (ATTDs). Our key emerging technologies are fully consistent with the DoD Critical Technologies plan and represent a significant investment by the Army in those technologies forecasted to provide the future Army with leap-ahead warfighting capabilities, to support our resource constrained force modernization plans, to enable us to achieve technological superiority, and to avoid technological surprise.

We continue to seek out, identify and support dual use technologies. The Army has made significant progress this past year in expanding our domestic technology transfer program. The number of our cooperative R&D agreements is growing and their yield is expanding. Last month, an agreement was signed between Fort Monmouth and the New Jersey Commission on Science and Technology to allow private researchers to benefit from the Army's Electronic Technology and Devices Laboratory and the Communications-Electronics Command. The Electronics and Technology Devices Laboratory at Fort Monmouth has an "open laboratory" policy whereby academic and industrial personnel are strongly encouraged to engage in on-site cooperative efforts with government scientists and engineers. Presently, nearly 180 professors and students are engaged either full or part-time with ETDL researchers at no cost to the government. Such agreements are a significant step toward improving our defense posture, economic posture and national competitiveness.

Another example of how we are teaming with academia and industry in research is our Centers of Excellence program. In 1989 we competitively selected the team of University of Minnesota, Howard University, Jackson State University and Purdue for our Army High Performance Computing Research Center. This center brings government, university and industry researchers together at a world class facility to keep the United States in the forefront of supercomputing research. Competitors for this contract were required to have team members from Historically Black Colleges and Universities. In addition to strengthening the competitiveness of Historically Black Colleges and Universities, this approach funds outstanding students to get graduate degrees in this scientific area of national importance.

(CHART 2 - Army Technology Base)

The Army Technology Base Master Plan contains the Army's strategy for investing in science and technology. Our approach toward strategic planning for the technology base reflects a realistic assessment of the threat, sound technology forecasts, rapidly changing world events, the declining defense budget and the resources of not just the Army but other resources available through joint and cooperative ventures with other government agencies, our allies, industry and academia. In order to keep our technology forecasts and assessments current, we have the National Academy of Science's Board on Army Science and Technology performing a two-year study on strategic technologies for the Army of the future. This study will conclude next summer. The results of the study will be included in the 1991 revision of the Army Technology Base Master Plan.

As products emerge from our investment in research and technology, we are speeding their development and demonstration through Advanced Technology Transition Demonstrations. An Advanced Technology Transition Demonstration is a risk reducing "proof of principle" demonstration conducted in an operational environment rather than a laboratory environment. It seeks to demonstrate the potential for enhanced military operational capability and/or cost effectiveness. A plan for transitioning the demonstrated technology is required, along with exit criteria. This approach will significantly improve our ability to stay ahead of the threat research, development and acquisition cycle. It will help maintain U.S. superiority in conventional landpower technologies and provide the future Army with critical warfighting capabilities within fiscal realities.

(CHART 3 - ATTDs)

The Advanced Technology Transition Demonstration approach reduces the time from concept to development and is advocated not only by the Army but was also recommended by the Defense Science Board and the Army Science Board. Active participation by the user as well as the developer throughout the demonstration is required. This will enable the user to develop more informed requirements and the material developer to reduce risk prior to the initiation of full scale system development.

(CHART 4 - Armored Systems Modernization)

Advanced Technology Transition Demonstrations are a key element of the armored systems modernization acquisition strategy. The President's budget request includes technology base funding for a Common Chassis ATTD as well as a Component Advanced Technology Test Bed. Mobility technologies critical to the Block III tank, Future Howitzer, Future Combat Mobility Vehicle and Future Infantry Fighting Vehicle will be demonstrated in the competitive Common Chassis ATTD. We will also explore commonality opportunities prior to seeking approval for full scale development. The Component Advanced Technology Test Bed supports the Armored Systems Modernization Plan; however, it is not unique to it. This test bed will demonstrate component technologies such as the Advanced Tank Cannon, Fire Control System, standard vehicle electronics and integrated survivability. We have focussed a significant portion of our technology base to ensure that we overmatch the future threat. We have funded technologies which offer revolutionary capabilities for future weapon systems. This approach will allow us to force the threat to react and avoid regressing to a situation similar to that criticized by the 1985 Defense Science Board on Armor/Antiarmor.

(CHART 5 - Protection Lethality)

Our budget request also reflects a significant emphasis on electric gun technology. This revolutionary technology promises greater lethality for future gun systems. We are exploring both electrothermal and electromagnetic launch gun propulsion technologies. We are working jointly with the Defense Nuclear Agency and the Navy to advance pulse power component technology required to achieve the practical weaponization of electric guns. The Army/DARPA Armor/Antiarmor program has succeeded in seizing upon the innovation and resources of industry in a competitive environment to improve our national capability in armor/antiarmor. The Army intends to continue to support this effort beyond the current Memorandum of Understanding which expires this year.

(CHART 6 - Aviation Modernization)

Another example of technology base support to our force modernization plans is Army aviation. In the past year we have consolidated and focussed the technology base for more versatile, lethal, survivable and deployable rotorcraft. We are requesting in this budget funds for a cooperative Army/NASA/DARPA Rotorcraft Pilot's Associate Program which will result in the demonstration of critical technologies such as high resolution displays, advanced sensors and artificial intelligence for the integrated/automated cockpit of the future. This is essential if we are to stay ahead of the threat and maintain our worldwide pre-eminence in rotorcraft technology. We are a full partner in the tri-service Integrated High Performance Turbine Engine Technology program which will preserve our world supremacy in small gas turbine engine technology. Our turbine engine technology superiority led to the very successful T800 engine program. The technology for the T800 was advanced by our demonstrator engine programs conducted in the 1970's and 80's.

(CHART 7 - Advanced Technology for the Soldier)

No discussion of force modernization would be complete without pointint out that this past year has been a very successful one in terms of soldier oriented research and development. Our efforts in terms of medical research and development, biotechnology, light weight materials, directed energy protection, chemical and biological defense, the advanced combat rifle demonstrations, low altitude airdrop and our Soldier Integrated Protective Ensemble Advanced Technology Transition Demonstration will enable the soldier of the future to be even more effective and better protected on the increasingly complex and lethal battlefield of the future.

(CHART 8 - Our Bridge to the Future Army)

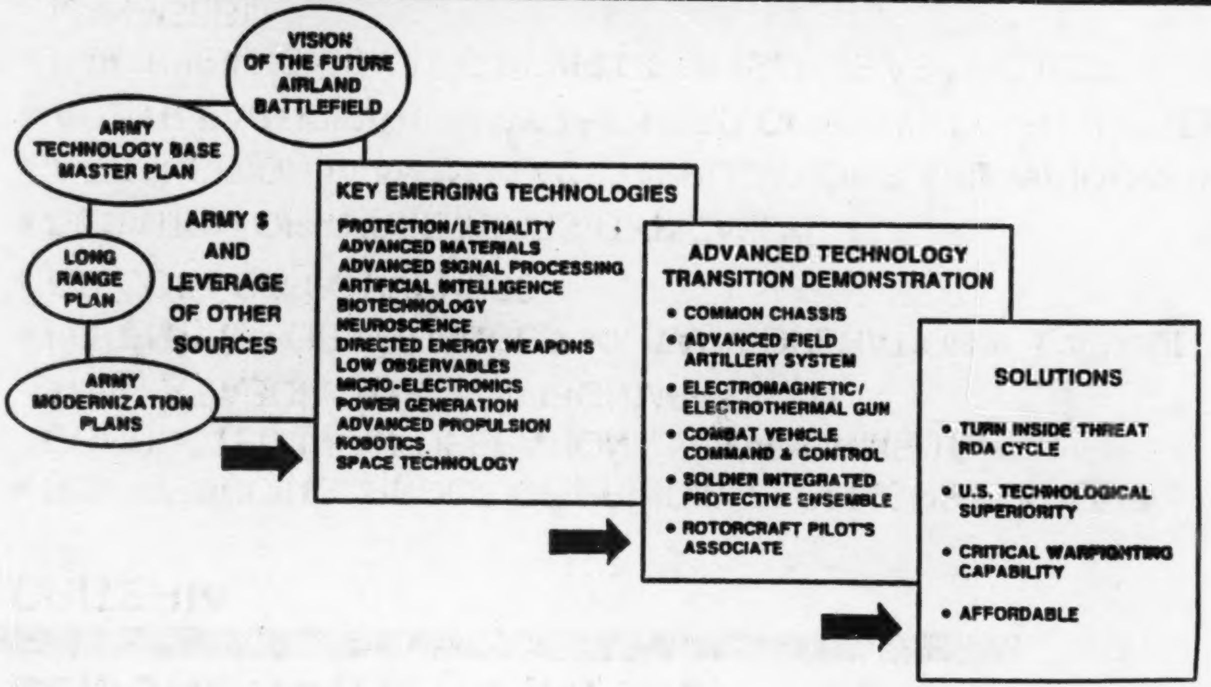
In conclusion, Mr. Chairman, we are focussing and harnessing the potential of our technology base. As defense budgets decline and international competition in science and technology continues to rise, we must protect our technology base. Technological superiority is a significant deterrent in itself. Technological superiority is essential if we are to defeat an increasingly lethal and wider array of potential threats to U.S. interests. Our Army Technology Base Master Plan is our road map to the future. With continued support, the Army technology base will ensure our technological superiority, avoid technological surprise and afford us revolutionary warfighting capabilities for the next century. The technology base is truly our bridge to the future.

ARMY TECHNOLOGY BASE

- PROTECT RESEARCH
- TECHNOLOGY FOR FORCE MODERNIZATION PLANS
- ADVANCED TECHNOLOGY TRANSITION DEMONSTRATIONS (ATTDs)
- KEY EMERGING TECHNOLOGIES FOR LEAP AHEAD WARFIGHTING CAPABILITIES
- EXPLOIT DUAL USE TECHNOLOGIES & DOMESTIC TECHNOLOGY TRANSFER
- ARMY TECHNOLOGY BASE MASTER PLAN REVISED TO REFLECT "NEW REALITY"

CHART 1

ARMY TECHNOLOGY BASE STRATEGIC PLANNING INITIATIVE



VISION OF THE FUTURE AIRLAND BATTLEFIELD

ARMY TECHNOLOGY BASE MASTER PLAN

LONG RANGE PLAN

ARMY MODERNIZATION PLANS

ARMY $ AND LEVERAGE OF OTHER SOURCES

KEY EMERGING TECHNOLOGIES

PROTECTION/LETHALITY
ADVANCED MATERIALS
ADVANCED SIGNAL PROCESSING
ARTIFICIAL INTELLIGENCE
BIOTECHNOLOGY
NEUROSCIENCE
DIRECTED ENERGY WEAPONS
LOW OBSERVABLES
MICRO-ELECTRONICS
POWER GENERATION
ADVANCED PROPULSION
ROBOTICS
SPACE TECHNOLOGY

ADVANCED TECHNOLOGY TRANSITION DEMONSTRATION

- COMMON CHASSIS
- ADVANCED FIELD ARTILLERY SYSTEM
- ELECTROMAGNETIC/ ELECTROTHERMAL GUN
- COMBAT VEHICLE COMMAND & CONTROL
- SOLDIER INTEGRATED PROTECTIVE ENSEMBLE
- ROTORCRAFT PILOT'S ASSOCIATE

SOLUTIONS

- TURN INSIDE THREAT RDA CYCLE
- U.S. TECHNOLOGICAL SUPERIORITY
- CRITICAL WARFIGHTING CAPABILITY
- AFFORDABLE

CHART 2

ADVANCED TECHNOLOGY TRANSITION DEMONSTRATIONS (ATTDs)

CRITERIA

- RISK REDUCING "PROOF OF PRINCIPLE" DEMONSTRATIONS CONDUCTED IN AN OPERATIONAL ENVIRONMENT RATHER THAN A LABORATORY ENVIRONMENT
- POTENTIAL FOR ENHANCED MILITARY OPERATIONAL CAPABILITY OR COST EFFECTIVENESS
- DURATION OF THREE YEARS (TYPICALLY)
- A TRANSITION PLAN IN PLACE (APPLICATIONS AND WINDOWS)
- ACTIVE PARTICIPATION BY THE USER COMMUNITY (PROPONENT)
- PARTICIPATION BY THE DEVELOPER (SERVE AS PROJECT MANAGER)

CHART 3

ARMORED SYSTEMS MODERNIZATION

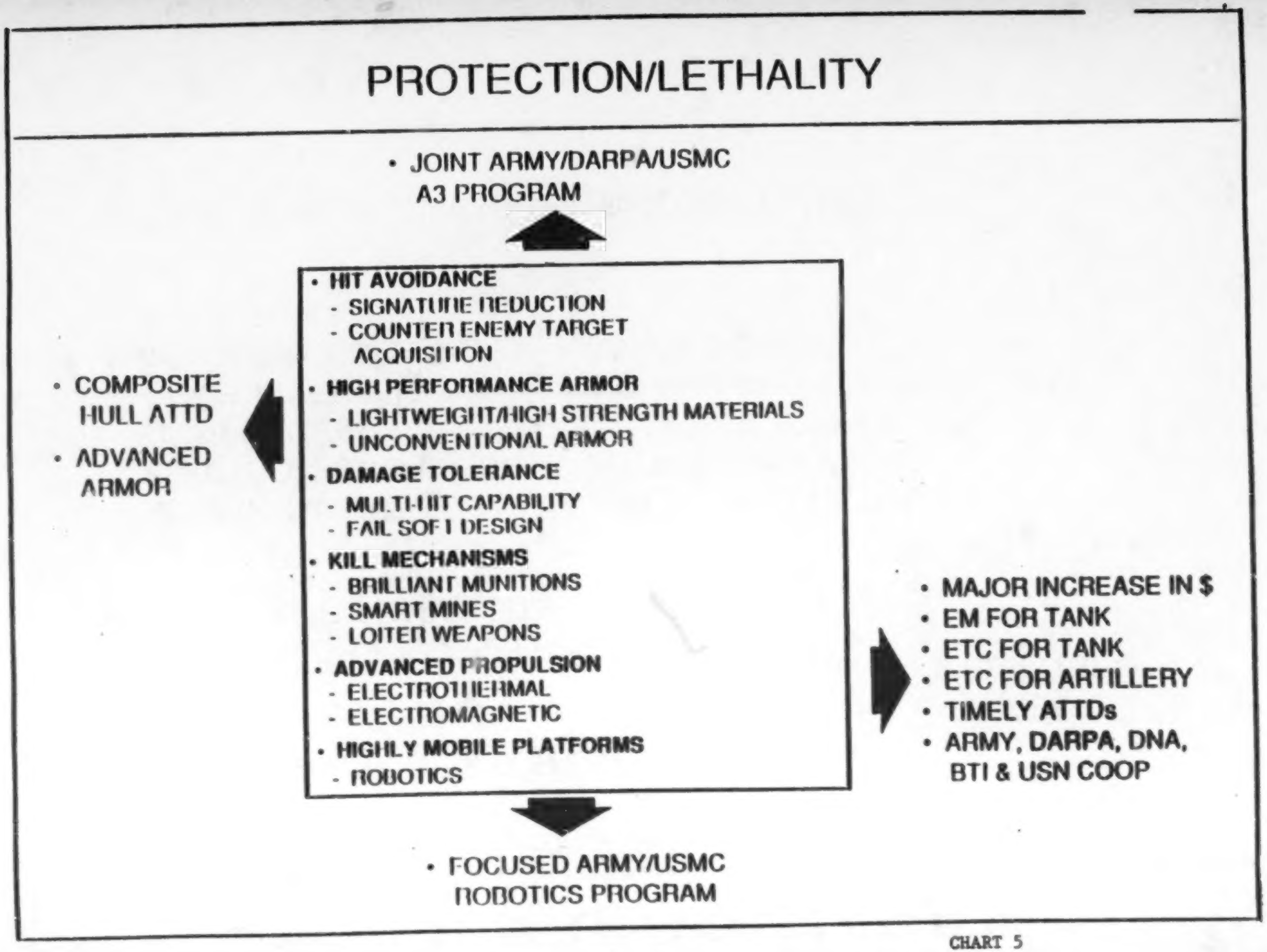
- FUNDED TECHNOLOGIES FOR OVERMATCH
- ADVANCED TECHNOLOGIES FOR REVOLUTIONARY CAPABILITIES:

THREAT REACTS!

  - ELECTROMAGNETIC / ELECTROTHERMAL GUN
  - COMPOSITES
  - COMBAT VEHICLE COMMAND & CONTROL
  - AIDED TARGET RECOGNITION
  - ADVANCED SENSORS
  - ADVANCED PROPULSION
  - AIRLAND BATTLE MANAGEMENT
  - ACTIVE DEFENSE

- ATTDs TO FOCUS & SPEED TECHNOLOGY TRANSITION

CHART 4



PROTECTION/LETHALITY

- JOINT ARMY/DARPA/USMC A3 PROGRAM

- **HIT AVOIDANCE**
  - SIGNATURE REDUCTION
  - COUNTER ENEMY TARGET ACQUISITION
- **HIGH PERFORMANCE ARMOR**
  - LIGHTWEIGHT/HIGH STRENGTH MATERIALS
  - UNCONVENTIONAL ARMOR
- **DAMAGE TOLERANCE**
  - MULTI-HIT CAPABILITY
  - FAIL SOFT DESIGN
- **KILL MECHANISMS**
  - BRILLIANT MUNITIONS
  - SMART MINES
  - LOITER WEAPONS
- **ADVANCED PROPULSION**
  - ELECTROTHERMAL
  - ELECTROMAGNETIC
- **HIGHLY MOBILE PLATFORMS**
  - ROBOTICS

- COMPOSITE HULL ATTD
- ADVANCED ARMOR

- MAJOR INCREASE IN $
- EM FOR TANK
- ETC FOR TANK
- ETC FOR ARTILLERY
- TIMELY ATTDs
- ARMY, DARPA, DNA, BTI & USN COOP

- FOCUSED ARMY/USMC ROBOTICS PROGRAM

CHART 5

AVIATION MODERNIZATION

- CONSOLIDATED & FOCUSED TECHNOLOGY BASE FOR MORE VERSATILE, LETHAL, SURVIVABLE, DEPLOYABLE & SUSTAINABLE ROTORCRAFT
- ARMY / NASA / DARPA ROTORCRAFT PILOT'S ASSOCIATE (RPA) ATTD FOR INTEGRATED / AUTOMATED COCKPIT OF THE FUTURE
- TRI - SERVICE INTEGRATED HIGH PERFORMANCE TURBINE ENGINE TECHNOLOGY (IHPTET) PROGRAM
- ARMY / NASA / USMC ADVANCED PLATFORM TECHNOLOGY PROGRAM

CHART 6

ADVANCED TECHNOLOGY FOR THE SOLDIER

- LIGHT-WEIGHT MATERIALS
- HIGH-STRENGTH POLYMERS
- FLASH PROTECTION
- LOW OBSERVABLES
- ADVANCED COMBAT RIFLE
- PORTABLE ANTITANK WEAPONS
- ELECTRO-OPTICS
- ENERGY DENSE BATTERIES
- MICROELECTRONIC COMMUNICATIONS
- GLOBAL POSITIONING SYSTEMS
- NEW RATIONS, e.g., MRE
- SURVIVABLE NBC CLOTHING
- IMPROVED FABRICS
- MICROCLIMATE COOLING
- AIR PURIFICATION
- MICROSENSOR DETECTION KIT
- MULTIPURPOSE CB DECON

CHART 7

ARMY TECHNOLOGY BASE

- TECHNOLOGY TO DETER & DEFEAT
- KEY EMERGING TECHNOLOGIES FOR TECHNOLOGY SUPERIORITY
- AVOID TECHNOLOGICAL SURPRISE
- MODERNIZATION FOR A MORE LETHAL, DEPLOYABLE, VERSATILE & SUSTAINABLE FUTURE ARMY
- ARMY TECHNOLOGY BASE MASTER PLAN IS OUR ROADMAP
- REVOLUTIONARY WARFIGHTING CAPABILITIES:
  - ELECTRIC GUNS
  - SMART WEAPONS
  - DEEP ATTACK
  - AUTOMATIC TARGET RECOGNITION
  - SIGNATURE CONTROL
  - AIRLAND BATTLE MANAGEMENT

OUR BRIDGE TO THE FUTURE ARMY

CHART 8

TURRET-LESS TANK

Mr. MURTHA. Mr. Secretary, I want to say that I am impressed that you have kept R&D at a high level. At one time, it used to be the other direction. In talking to Secretary Cheney, we agree that we should keep a high-quality, modern force and a ready force, and part of it is R&D, so I applaud you for attempting this and hopefully we will be able to keep this emphasis on R&D.

General Pihl, about this future "turret-less tank", I don't know that you mentioned it; you may have. I have people saying to me, and I am not sure they are experts, but they say this turret-less tank will never work.

What is the advantage and how much money are we spending on that?

General PIHL. The turret-less tank is a design goal for both the Soviets and Americans that was once investigated. The idea of putting a gun on top of an arm and getting the human beings down below the turret ring is the goal of such a system. Envision then having to get the bullets up some sort of a pipe into the gun, no fire control mechanism other than scopes rising up above the ring. Very technologically complex, I would assert. Both countries, as a matter of fact, are going to what is now called a reduced volume turret.

We have found that we can't just have an elevated gun sitting up there by itself, so through the process of putting an auto loader into the tank, reducing the crew from four to three, and perhaps to two at some time, you would have less presented area. You want to expose less of yourself to the enemy so that you won't be shot, hit and killed. To date, we have only spent the money in terms of a Block III design. Our next upgrade beyond the Abrams Block II tank is to look at a reduced volume turret, not a true turret-less tank.

Mr. MURTHA. I understand we are tying to protect people, but I wonder about the cost. If you knock the turret out anyway, the gun is not going to be of any value.

What is the philosophy there? It doesn't make sense.

General PIHL. It doesn't to me either. Ultimately you could picture a world where robots are fighting with one another and there are no people involved in the battle, but we think we are still well short of that as a vision of what mechanized combat is going to look like.

CHANGING/LIGHTER ARMY

Mr. MURTHA. Have we changed our strategy since the threat has declined? We have got to lighten up the Army. Are we moving in that direction or have you had an opportunity with the threat changing so rapidly to change the thrust of the R&D?

Mr. CONVER. We have. I think it is the existence of the strategy that made that possible. We are lightening the force, but trying to maintain in all of our modernization programs three essential criteria, and I think this is entirely consistent with a smaller, lighter Army. We want the forces to be deployable.

In the case of the LH helicopter, those aircraft will be self-deployed to Europe either by the southern or northern route. So deployability is one important thing. Versatility is important. We need to be able to fight on the low end of the spectrum as well as on the high end and with the same weapons systems. We no longer have the luxury of being able to have single-purpose weapons. We need to retain the lethality of our systems even though they may be lighter.

I guess it is a fortuitous circumstance if you want to look at it that way the Army has been driven into making these decisions, I think, earlier than the other services, because we have been hit a little harder in the budget drills, so we have had to start the process of rigorous self-examination ahead of the other guys, and I think we find ourselves in pretty good posture, although we don't have very much money.

Mr. MURTHA. Thank you.

Mr. McDade.

REMARKS OF MR. MC DADE

Mr. McDADE. Thank you, Mr. Chairman.

I want to take a minute to welcome my good friend Steve Conver here. All of us are delighted to see you in front of the committee. You have been a member of the organization on the Hill here for a long time and we know you will bring particular insights into the problems. We welcome you and look forward to a long association with you and congratulate you and the Administration for picking a man of your caliber for your job.

Mr. CONVER. Thank you, sir.

Mr. McDADE. That is a rumor going around that says this might be your last appearance, General Phil, in front of the committee.

General PIHL. I suspect so.

Mr. McDADE. How many years of service to the country?

General PIHL. Thirty-one.

Mr. McDADE. I know I speak for all of us when I extend our deepest gratitude for all the work that you have done.

I look at all these modernization programs, whether armor or trucks or whatever, and the fellow who has managed all of them with exemplary skill is Don Pihl.

I wish the other Services could emulate what you have done because you have not only established a planning system that is peculiar to the problems that the Army brings to the committee, but the best I have seen among the Services. Unfortunately, we don't find it across the spectrum, but they don't have a Don Pihl to do the planning.

No individual coming before the committee has the credibility in my judgment with the Members and with the staff that you have. You have taken the hardest decisions possible thrown at you by this committee and individual Members, including this one, who have told you, "All right, pull the rabbit out of a hat," and 99.9 percent of the time you did it, and with dedication and hard work and skill.

You will be missed greatly. We hope to be able to keep personal relationships going. It is hard here, but we do extend our deepest appreciation on behalf of the Nation for all the contributions that you have made. They are without parallel and we are deeply grateful to you.

General PIHL. Thank you, Mr. McDade.

BLOCK II MODERNIZATION

Mr. McDADE. Let's look at this Block II modernization.

We have about $300 million in research and development invested.

The Army changed its plans for the production of the Block II tank and decided to purchase only 62 tanks rather than the original plan of almost 3,000, and the decision, of course, was driven by changes in Europe, by force reductions, and the prospect of a declining budget.

Given these changes in the Army's plans, how can you justify continuing the M1A2 program?

What is the justification for it?

General PIHL. The M1A2 justification is an argument for continued lethality and survivability and to upgrade the tank to make sure that you are capable of defeating the future Soviet tank 2. That tank, we believe will come into inventory in the middle of this decade.

The argument for Block II is to put the Armored Enhancement Initiative bullet, the 120 millimeter bullet upgrade—it is a ——— long rod penetrator that will be capable of performing defeat of the armor that we think that tank is going to have, while at the same time increasing the fighting capability of the tank by putting a separate commander's weapon station on the tank, the commander's independent thermal viewer and weapons station. What you have is an independent capability for the tank commander to find the target while the gunner has just killed the target the tank commander found just a second ago.

So the tank commander is now turning independently from the tank turret rather than being a slave to the turrent as he is today or to get up in his T-shirt with a pair of binoculars and to look outside for targets which we don't think he can do and survive.

We are going to get the commander inside the tank with the kind of optics he needs to find tank targets on the battlefield. This is an independent thermal viewer.

We want to bring the tank into the modern age in terms of its vehicular electronics. We want to put aviation avionics into the tank so that it provides digital fire control and digital displays where he keeps the data that he needs to fight the battle.

There would be one of these stations at the tank commander's location and at the gunner's location.

So we are putting modern fighter plane avionics into the tank as opposed to the black boxes and wires that we have in the tank today.

Why only 62? Sir, it is a theory, and it may be academic, that we are going to lay away the line having tooled up to produce the Block II tank in this modern configuration, so that if there is a reversal in what we see going on in the threat, you will have the capability to call back the more modern and more capable tank rather than laying away a line that would cap it at the M1A1 level of performance.

Mr. McDADE. What we think about is when you limit it to 62—and we understand what you are saying about a theory and trying to hedge the bets—all of the requirements to support those 62 tanks, the depots, all the infrastructure, the difficulties of getting people back if you had to turn around and come to meet a threat, are really on the flip side of the coin, aren't they?

General PIHL. Yes, sir.

Mr. McDADE. A lot of people are concerned that if we do this—we recognize it is basically an affordability question, General.

General PIHL. That is correct.

Mr. McDADE. No question if there were additional resources available——

General PIHL. We would buy back 2,900 tanks.

Mr. McDADE. Or some number in between.

What do you expect the eventual total cost of R&D for the program is going to be?

General PIHL. For all of Block II, for 62 tanks—can I come back on that?

Mr. McDADE. Yes. I want the total cost of procurement for that program and the eventaul procurement cost of each tank and how that would compare with the current tank.

General PIHL. Yes, sir.

[The information follows:]

The Block II Program RDT&E fund requirements from FY 1985 to FY 1989 totaled $223.4 million. FY 1990 through FY 1993 requirements totaled $232.8 million, for a combined total cost of $456.2 million. These efforts include support for several related projects which are not Block II peculiar, such as training devices, classified armor efforts, and a weight reduction program.

Procurement costs associated with the M1A2 total $237 million for FY 1990 and FY 1991. In escalated dollars, the Weapons System Cost for the M1A1 tank is $2.9 million/tank in FY 1990 and $3.5 million in FY 1991. The Weapons System Cost for the M1A2 is $4.7 million in FY 1991.

M1A2 TANK COST

Mr. McDADE. The Army has submitted a $39.6 million reprogramming for the M1A2 in fiscal year 1990 R&D funds.

What has happened to the cost? It looks like the appropriated level of $57.6 million to your current 1990 requirement of $97.2 million—it looks like there is a lot of growth in there.

What has happened to that cost?

General PIHL. Sir, we have had some cost growth in the M1A2 as we look at General Dynamics. As the system integrator buying from the various subcontractors, they have the six different components of the Block II tank.

Dr. Costello imposed a $300,000,000 per-tank cost cap on the current price and said we could not procure the tank at greater than $3,018,000 per tank. That was two years ago at the Defense Acquisition Board. The actual cost to integrate the six components is $532,000 per tank. The principal driver on that is the cost of the commander's independent thermal viewer, which is the thermal sight for the separate fighting compartment for the tank commander.

We think the costs will go down after we get a run and put together the full-scale engineering development models that we are going to use for testing. We are now denied three parts of the Block II tank that we based our budget estimate on. Department of Defense has not approved an armor package upgrade, the position navigation device or the CO2 laser range finder. So out of the six upgrades that we wanted to put into the Block II, we have permission for three.

Mr. **McDade**. Walk through those three with me. You talked about the sight.

General **Pihl**. We have the CTTV and the independent commander's weapon station. That is a package, and that is an approved package. We have the core electronics upgrade to put the avionics, that is approved. We have the AEI round that integrates to it and the kind of computer you need to put in there to fire the new rounds.

That is approved. We have not had approved an upgrade in armor package, the CO2 laser range finder and the position navigation device.

Mr. **McDade**. Does the flow from the decision two years ago to cap at $300,000,000?

General **Pihl**. It does. Mr. Betti challenged us at the last DAB to come back and prove by analysis and test the worth of those three components and/or bring the tank in at a cost cap of $3,018,000. We can no longer do that because we have taken the base from the program away by canceling 2,900 tanks.

Mr. **McDade**. Unit costs are going through the roof?

General **Pihl**. If you believe in laying away an important capability, the unit costs will approach $4.5 million a tank, Mr. McDade.

Mr. **McDade**. Is that also the reason that the R&D estimate in 1991 has gone up to $77.7 million from $34 million?

General **Pihl**. Yes, sir.

By taking away the base, which was the 2,900 tanks across which the R&D would have recouped.

ALTERNATIVES FOR REDUCING UNIT COST

Mr. **McDade**. I don't know how to move that unit cost. Obviously, 2,900 was the maximum efficient rate you thought you could procure the tank and get the cost down.

General **Pihl**. Yes.

Mr. **McDade**. With 62, you are driving them through the roof. Is there some number that looks like a number that would mitigate those unit costs? What is that number?

General **Pihl**. Sir, we would have to build at least 360 tanks a year to approach a unit cost that would be in the threes rather than in the fours.

Mr. **McDade**. Three hundred sixty would be a combination——

General **Pihl**. Foreign military sales and U.S. production.

Mr. **McDade**. To keep the base that would hold the pricing, because I am told that since the new budget submission has come up, the impact on the unit price to the potential foreign sales customer is also through the roof.

General Pihl. Yes, sir.

Mr. McDade. Enormous cost growth, isn't it, $2 million a unit?

General Pihl. Between $1 and $2 million per unit based on building only 62 American M1A2s.

Mr. McDade. If you were to try to mitigate the R&D costs, hold the FMSs in place at the advertised price, how many tanks would have to be bought across the base to get to that roughly 300 that you said was a number that would hold the prices in check?

General Pihl. In 1991, we procured 163 M1A1s and 62 M1A2s, so 100 and 360 brand-new sales starting the next year.

Mr. McDade. Unless you decide that you wanted to extend the base of U.S. production.

How does that scenario work?

General Pihl. Depending upon the sales rate, and I think the Egyptian case is 500 tanks over two years, I think it is—no, it is 60—excuse me. I have lost the figure.

Mr. McDade. That is a very complex equation and we got into this talking about the R&D and seeing costs soaring because of the cap and the unit costs.

Would you show us the different scenarios in the record that would produce a drive-down of the unit costs of the U.S. procurement and a stabilization of the FMS costs where we went out and talked to people apparently and now the advertised price has grown by a million two——

General Pihl. I will do that.

[The information follows:]

In order for the U.S. to achieve a saleable, or below $4 million tank cost, it must procure the following quantities of M1A1s or M1A2s:

WEAPONS SYSTEMS COST

[In millions of dollars]

	20/month	30/month	40/month
Escalated dollars:			
M1A1	4.4	3.7	3.3
M1A2	5.2	4.4	3.9
FY 1990 constant dollars:			
M1A1	3.7	3.2	2.8
M1A2	4.4	3.8	3.3

Assumptions for developing the above costs were a multiyear contract, one tank plant assembly, inclusion of the Government of Egypt coproduction effort with no other Foreign Military Sales in the calculations, the August 1989 DAB approved M1A2 configuration, and an average unit Weapon System Cost over the FY 1992-1996 time period.

Based on the above scenarios, The Department of Defense must commit to procure at least 25 M1A1s or 38 M1A2s per month to create a base for attractive price quotations to potential foreign military sales customers. Of course, any foreign military sales will drive these unit costs down depending on the total quantities procured by the foreign country and the United States.

General Pihl. You have an opportunity here as well. We have in the inventory now 2,374 M-1 with a 105mm gun, the original tank we started procuring in 1979. We built 894 improved M-1 tanks, which was an increase of the armor package on the turret. Those tanks sit out there with a 105 caliber gun. An idea would be to retrofit those tanks to the M1A1 capacity and switch out the 105mm gun for the 120mm gun, which would establish a warm base while you are running that retrofit program.

Mr. McDade. We appreciate that and any other suggestions. Certainly you have worked long and hard on the program and we would appreciate the benefit of your views about it.

[The information follows:]

The Secretary of Defense has stated that 8000 tanks are enough to meet the nation's defense requirements, so the Army is now looking at what can be done to improve its existing tank fleet as an alternative to procuring more tanks beyond FY 1991. The retrofit option is one of those which the Program Executive Officer—Armored Systems Modernization is now working.

Two parallel efforts are now underway. The Abrams Program Manager is doing configuration work, and General Dynamics Land System was tasked to determine the cost and feasibility of the following three separate options, should it become necessary to improve the Abrams fleet capability before the Block III tank is ready: Up gun the current fleet of 2,374 M1 and 894 IPM1 tanks from 105mm to 120mm cannons; up gun the M1 and IPM1 fleet per the above and further convert them to an M1A2 configuration; convert the M1A1 fleet (approximately 4,500 tanks) to the M1A2 configuration. The basis for the study of the options included: Total expenditure for this effort cannot exceed $500 million per year (the closer to $400 million, the better); and the retrofit should have an objective of keeping the industrial base warm, and if possible, a tank plant operational, and support FMS requirements. Regardless, the retrofit must be performed in the most cost effective manner.

The data is not expected to be provided to the Program Executive Officer for analysis by GDLS until the middle of April 1990. The data and analysis will be provided to the Department of the Army when and if any of the alternatives make sense. A key point is that the study may show that retrofit may not be cost effective or feasible.

The Army has previously studied upgrading the Abrams 105mm fleet to the 120mm gun, which was planned to be accomplished at Anniston Army Depot. At the time, it was determined that it was more cost effective to produce new M1A1s than up gun the older fleet.

M1A2 VERSUS M1A1 TANK

Mr. McDade. Tell us how much more effective the tank is going to be than the current M1A1 and why the Army wants to develop a tank which apparently has little significant increase in effectiveness over the current model.

Is that a fair statement?

General Pihl. That is not.

Mr. McDade. Describe the capabilities to us.

General Pihl. In terms of what our models tell us with two major armored forces fighting one another, both in the offense and in the defense, you will get a 119 percent increase in effectiveness in terms of the defense as you are sitting there and in terms of an offensive scenario, our models tell us you will gain up to about a 54 percent increase because by putting the commander independent from the gunner and being able to find more targets on the battlefield, you are actually increasing the effectiveness of the tank, finding more to shoot at faster and, therefore, you will have more tanks survive. So to those who say there is no lethality argument behind the M1A2, I say nonsense. it is all about lethality.

Mr. McDade. I don't know how to quantify 100 percent more effective in lethality and 50 percent in defense, but I am hearing you say a much more efficient machine which would enable you to face the threat in the out-years with fewer tanks?

General Pihl. That is correct, sir.

Mr. McDade. How do you quantify 100 percent more——

General Pihl. In terms of targets killed, say we had a formation of 300 and you lost 100 in the fight; in this case you would perhaps only lose 50, or be outnumbered six to one. Where each of your battalions are fighting a Russian regiment.

Mr. McDade. That is very, very helpful to know.

General Pihl. That is in the defensive mode.

GAO REPORT ON M1A2

Mr. McDade. The GAO recently released a report critical of the Army's plans for the M1A2. Among other things, the GAO questioned the Army's weight reduction plan for the Block II tank.

What is the status of the plan and what is the current weight of the M1A1 tank?

General Pihl. We can bring the M1A2 in at about 69 tons; U.S. tons, 2000 pound tons. If we don't get the weight reduction approved in the design and we simply bolt on this material, the tank will grow to about 71 tons. So right now, we can field the M1A2 with the weight reduction program at about 68.5 tons.

M1H2 MILESTONE SCHEDULE

Mr. McDade. Tell us what the major schedule milestones for this program are and how do they compare with the original estimates.

General Pihl. The next milestone is the Defense Acquisition Board in January 1992 where we go to see Mr. Betti. He will, if we are successful, approve that for a limited production run of 62 tanks and we will produce the tank in late 1992.

Mr. McDade. General, I appreciate your candid answers and will you answer the last question for the record, please.

[Clerk's note.—Question submitted for the record and the answer thereto follows:]

Question. The fiscal year 1990 budget supported a total of 2,926 tanks for a unit cost of approximately $3.04 million. What is the current 1990 unit cost per M1A2? What is the 1991 unit cost per M1A2?

Answer. There are no M1A2s supported in the FY1990 budget. The 1991 unit cost for 62 M1A2s is $4.7 million (FY 1991 ESC $). This is a larger cost than the earlier estimates due to production rate inefficiencies, limited benefit in learning curve (62 VS. 2,926), buying them through a single year instead of multiyear contract, and refinement of cost estimate from pre-PDR to post CDR configuration. Additionally, the cost estimate did not include non-recurring cost, and loss of not to exceed prices.

[Clerk's note.—End of questions submitted for the record.]

Mr. McDade. Thank you, Mr. Chairman.

TANK PRODUCTION—MIA2

Mr. Wilson. Thank you.

General Pihl, I think that Congressman McDade's questions were all pertinent.

There might be, as Mr. McDade says, some other number that we could find that might help reduce the R&D costs, but I think the principle of developing the weapon and then producing enough of them so we have an absolutely proven record with their performance is a good idea and a principle that we should pursue as we go forward.

This is an old bag of bones I am going to beat for a few minutes.

TEST OF THE ANTITANK WEAPONS

There is no greater support of the AAWS-M in Congress than I am, not even Mr. AuCoin, but the authorization committee directed the Army to test the manned portable anti-tank weapons.

I just don't understand the Army's absolute reluctance to test. I am not a proponent of buying the BILL or the Milan or anything else, but I don't understand why the Army refuses to put the Dragon into the field and to do the test that were directed by the authorization committee.

Mr. CONVER. The Authorization bill directed a side-by-side test and told the Army they should essentially fund it with unobligated funds; essentially out of hide.

Mr. WILSON. How much does the Army think it would cost to conduct the test?

Mr. CONVER. I wanted to say $30 million, but I am not sure. I think there are two problems. First of all, I guess I will tell you I don't sense great enthusiasm in the Army or in the Department of Defense for executing these tests.

Mr. WILSON. That is clear.

Mr. CONVER. I don't think there is enthusiasm.

Mr. WILSON. Why?

Mr. CONVER. General Pihl probably has a better understanding of this from the military point of view. The Army has convinced itself that neither the Bofers BILL or Milan weapon or the Dragon are effective against the next generation of tanks. We are ready to move on.

Mr. WILSON. Say we have invaded Nicaragua, which has a large number of T-54, T-55 Soviet tanks against which very likely the Milan and the BILL are effective, and say that the Army had to go in there with Dragons.

Where would the soldiers have been?

Mr. CONVER. I think there is an analogy to what we are doing with the tanks and helicopters. I think the Army ideally would like to cover the near-term threat, the low-intensity conflict threat, as well as the future high-intensity threat against the Soviets or a major adversary, but as we did with the tanks and helicopters, we have put ourselves in the position because of dollars of being willing to accept a near-term risk for the kind of eventualities that you mentioned. Because there are not enough dollars around to do the side-by-side testing, some limited production of one of those three existing systems, plus to proceed with the AAWS-M, which we think is the way of the future.

So given that we couldn't do everything, our strong preference is to proceed with the new system and I think that is entirely consistent with the chief's strategy, with our emphasis on the far-term threat, with our willingness to accept near-term risk in the current threat environment. We would like to do everything, but frankly, given the choice, we strongly prefer to go with the new, more capable system.

Mr. **Wilson**. Of course, no one is asking you to buy either one of those systems. We are just kind of getting down to a shouting match about whether or not you are going to do what the authorization committee said and conduct the test.

Mr. **Conver**. I would say—and I have not been in this job long enough to definitively make this statement—but I think General Pihl will verify that the Army believes what I am about to tell you, which is that faced with spending $30 million on the side-by-side of Dragon, the Bofers BILL and the Milan weapon, there are many, many things that the Army would like to fund before it proceeded with that. Having said that, we intend to be responsive to the law. The problem with executing what the law has directed us to do is a question of time and money. The unobligated balances that the authorization committees had identified, some of which were in the Marine Corps, were already expended. The money is not there.

In order to execute this directive, we need to come back in with a reprogramming. The Army is currently preparing a reprogramming action which we will submit to the four committees and be guided by your judgment.

The other problem is time. The bill required us to have the tests completed by the end of May of this year and even if we did have the money, there wouldn't be time to meet that date. I think we are looking at something—even if we get the money in a reprogramming, we are looking at probably completing the tests a year downstream of when we were required by the law to do it.

Mr. **Wilson**. Have you looked at the possibility of sufficient funding being available in the NATO and non-NATO cooperative testing program?

General **Pihl**. Sir, we are looking into that. We were directed to reprogram $10 million. We first looked at taking the money out of AAWS-M.

Mr. **Wilson**. That is kind of tricky.

General **Pihl**. That is the mission area with which we have the funds to spend in the medium anti-tank missile system. I went scrubbing for the money and that is where I found it. To get the money out of foreign weapons testing or to look for previously unexpended balances, that is our guess now. My budget officer and I are having a very difficult time. We are making a sincere effort to do so.

Mr. **Wilson**. Nobody said that yet.

General **Pihl**. The problem is one of execution and the mechanics of coming up with this. We will probably, in order to accommodate the law, have to come over with a billpayer that is U.S. Army money to offset the need for this test.

Mr. **Wilson**. I believe everything you say. Don't you think $30 million is a little bit of a bloated estimate?

General **Pihl**. If I may say in terms of operational test and evaluation, that is what the testers would like to see to have a complete test of the three candidates side by side. Yes, we could test it for less than that, I am confident of that.

Mr. **Wilson**. Mr. Miller.

Mr. **Miller**. No questions, Mr. Chairman. I will yield.

Mr. WILSON. Mr. AuCoin?

ADVANCED ANTITANK WEAPONS SYSTEM-MEDIUM

Mr. AUCOIN. Thank you, Mr. Chairman.

General Pihl, we have talked about the AAWS-M, which I understand you have chosen a name for—is it now called Predator?

General PIHL. I believe that is the name that is being mentioned; yes, sir.

Mr. AUCOIN. Which I appreciate seeing, because AAWS-M is about the least descriptive name for a weapon system I think I have ever heard.

General PIHL. No, sir. In the troop vernacular, though, it is called Awesome.

Mr. AUCOIN. Awesome is fine, but AAWS-M leaves a lot to be desired.

Let's go over a couple of things that we went over in a previous hearing because I wouldn't want to let the record stand without some of those comments and perspectives that you brought to the committee earlier as did the Commandant of the Marine Corps on this weapon.

With regard to the tests that Mr. Wilson has indicated he is eager for you to conduct, my recollection—you tell me if it is yours—is that the Commandant of the Marine Corps felt that it would be a "complete waste of time and money."

Is that your recollection?

General PIHL. Yes, sir. That is my recollection.

Mr. AUCOIN. As you recall that exchange between the Commandant and myself and between you and me in that hearing, wasn't the reason for the Commandant's statement, which largely paralleled your point of view, that the test results of Bofers BILL against the Dragon are very predictable?

Those tests would show that the BILL has longer range, everybody knows that, but is also heavier than the Dragon; and secondly, that the BILL is ineffective against reactive armor.

Isn't that roughly the substance from which the Commandant drew that conclusion?

General PIHL. Those are both true statements.

Mr. AUCOIN. Isn't it also true that in the hearing, it was brought out that our best estimates are that by the time AAWS-M is deployed, the Soviet armor threat will probably be 50 percent reactive armor?

General PIHL. Yes, sir; at least.

Mr. AUCOIN. Wasn't it also brought out in some detail in that hearing that the Marine and the infantryman need a light and effective anti-tank weapon, and that with the case of the Bofers BILL, you have a 118-pound weapon, whereas AAWS-M is coming in close to 42, 43 pounds, somewhere in that vicinity?

General PIHL. Yes.

Mr. AUCOIN. One hundred eighteen pounds is even heavier than the Dragon is.

General PIHL. Much heavier. The Dragon is about 57 pounds.

Mr. WILSON. The gentleman is leaving out the best argument, that the AAWS-M is fire-and-forget.

Mr. AuCoin. I am coming to that.

The Bofers BILL requires how many men?

General Pihl. The BILL is a two-man system, 80 pounds, for one missile, a launcher and a night sight, but when you weigh it out with all of its kit, it is 118 pounds.

Mr. AuCoin. The AAWS-M——

General Pihl. Forty-five is the requirement and it is a one-man operation.

Mr. AuCoin. It is true fire-and-forget?

General Pihl. Yes.

Mr. AuCoin. In terms of its lethality, the lethality specifies it is something that is classified, and this is a closed hearing.

The AAWS-M is being designed to be effective against —— is that correct?

General Pihl. That is correct; ——.

Mr. AuCoin. The Bofers BILL is not effective even against a fart less robust reactive armor tank?

General Pihl. Yes.

Mr. AuCoin. The test in question is between the Dragon, which we know is a piece of junk, and Bofers BILL and Milan; is that true?

Genreal Pihl. Yes sir.

Mr. AuCoin. So what we have in the test that is proposed is a test that will pit multi-manned weapons that are not effective against the reactive armor threat, against a piece of junk that the infantryman has told me that they have been wanting to get rid of for 20 years and has nothing to do with what the AAWS-M represents, which is highly lethal against reactive armor.

Isn't that true?

General Pihl. That is correct, sir.

AAWS-M ALTERNATIVES

Mr. AuCoin. Are there any show-stoppers in the development of AAWS-M that gives us the suggestion that we may need some near-term opening of a production line in order to have a fall-back position of this kind, any show-stoppers yet?

General Pihl. None that we know of. It is at cost, within risk and on schedule and it is performing. We have had an excellent firing profile when we tested it. We had two other candidates who were fully qualified, a laser beam rider and FOG-M. Were we to not go forward.

Mr. AuCoin. That gets to the next question. If you did find a show-stopper, what would you turn to?

General Pihl. To the other two teams that competed for the AAWS-M requirement, both of which passed, but were not as superior as the Texas Instrument candidate.

Mr. AuCoin. You had an unusual amount of competition for this advanced technology follow-on to the Dragon.

You had a fiber-optic-guided system which was effective, you had a laser beam rider system which was effective, and you had this smart projectile weapon with true fire-and-forget, which we now call Predator, which is AAWS-M.

In our previous hearing, you indicated that because of the robustness of that competition between three high-technology, but very effective promising systems, if something happened that absolutely stopped the show on AAWS-M that rather than going to a multiman, heavy 118-pound weapon system that is awkward to handle and that is certainly not a single infantryman's weapon that he can carry all day and shoot all day and be highly mobile and fire-and-forget, that you would turn to either FOG-M or laser beam rider, which lost out in the competition; isn't that correct?

General PIHL. Yes, sir.

Mr. AUCOIN. I appreciate those answers because I know what Mr. Wilson's interest is. I suspect where he is coming from. I do disagree with the conclusion he has reached, but I know that both of us have the infantryman's interest at heart here and are trying to come up with what is in the infantryman's best interest.

I believe it is staying on track with AAWS-M, and authorizers can make mistakes and I think they made a gross mistake in requiring this frivolous test which the Commandant of the Marine Corps said is a total waste of time and money. I agree with him on that one.

LOCKOUT DEVICES

I want to ask you a question about something that Mr. Livingston and I encountered when we visited Huntsville last week. When we were there, we were on an SDI briefing tour, but we took some time for a quick briefing on AAWS-M. One of the issues that came up was where you are heading on that congressional mandate that you were given for a lockout device for Predator.

Mr. WILSON. What kind of device did you say?

Mr. AUCOIN. A lock-out device which would enable us to by electronic means keep these weapons from being active and effective if they fell into the hands of a terrorist or—if we lost control of them.

With the problem we have with the acquisition and use by terrorists of Stingers, I sure don't want to see AAWS-M create a parallel problem. I dread the thought of seeing an AAWS-M some day used by a lunatic taking aim at the President's limousine somewhere in the world and that is what this lock-out device was all about. You can't—I know you agree—you can't rely on physical control of these arms for the security because inevitably some of these things are going to be lost from an inventory; it is just bound to happen. I think the intent of the Congress when we mandated that lock-out device was to use electronic means to maintain positive control over every single AAWS-M produced regardless of who owns it. I understand that we have the technology to do that by electronic means and the only way that we could lose control is if the terrorist has the ability to design and make his own microchips, which I think is a couple of pay grades beyond the intellectual capacity of Qadhafi.

The briefing at Huntsville suggested that you are coming up with a scheme that may not meet those kinds of lock-out requirements. Rather than go into detail on this today, I understand that there is an option maybe being developed on this question——

General PIHL. That is correct.

Mr. **AuCoin**. I was being briefed on only one of the options under consideration and that it will be available the end of the month. Would you notify the Committee as soon as the paper is ready and give me a briefing on it? I think the Committee would like—I would ensure that the Committee staff is briefed on it at that same time.

General **Pihl**. Yes, sir, I will do that.

Mr. **AuCoin**. Mr. Chairman, I have more questions, but I am willing to wait for a second round.

Mr. **Wilson**. Mr. McDade?

LIGHT HELICOPTER PROGRAM

Mr. **McDade**. Thank you, Mr. Chairman.

Turning you attention to the LHX, General, this is a key decision year for LHX.

The budget request includes $465 million to initiate "full scale development" after choosing a winning contractor team in 1990. Is that correct?

General **Pihl**. Yes.

Mr. **McDade**. Tell us what the status of the LHX development program is and what results have you seen so far?

General **Pihl**. We are at 15 months of 23 in a demonstration and validation program with the two major teams, both proposing against our request for proposal. We believe the McDonnell-Douglas/Bell team and the Boeing/Sikorsky team will come in September of this year with the results of demonstration and validation.

Those are proprietary at the present time and they have not been to the source select authority for decision, so I don't have any emerging results except to say that the two standards, 7,500 pound fly-away empty weight helicopter and the $7,500,000 in fiscal year 1988 dollars cost cap are absolutes as far as the Army is concerned. It is up to the two design teams now to make the performance tradeoffs and tell us what we are getting in what may be some compromises that they will have to take and to select one of the two teams in January 1991 to carry the program into full-scale engineering development.

Mr. **McDade**. Will you be ready for FSD in 1991?

General **Pihl**. We believe so, sir.

Mr. **McDade**. Considering the Army's current proposal to arm the AHIP, what mission is left to be accomplished by the LHX?

General **Pihl**. Really two missions. First of all, light attack, to be a complement to the Apache and armed reconnaissance.

There will be some aviation units in the end state force structure 1997 and beyond that have only the LH particularly cavalry units forward deployed.

We believe that armored reconnaissance will be performed all over the Army so that you do preparation of the battlefield by light-armed helicopters. With the AHIP now being capped at 243 helicopters, that will become the low end of that scout mix in the Army.

Mr. **McDade**. You see declining curves and declining dollars downstream. Do you think there is room for both the Army AHIP and the LHX in the out-year budgets?

General PIHL. We have made room within what I call the Aviation Modernization Plan and as long as we can keep Army aviation funded at that level internally and tradeoffs we make in the department at the present time, we have made room for both.

Mr. McDADE. I suppose we could see revisions of that when you start doing your five- or six-year POMs?

General PIHL. Yes.

Mr. McDADE. Time frame?

General PIHL. We revise it annually and it has gone from $3.5 billion when I first briefed it to you down to $2.2 billion, and it is headed for $1.8 billion. I remind myself as I look back to the days in 1987 when we put the aviation mod plan together, the Army had only one funded helicopter production program, the Black Hawk.

All other programs were cancelled and the DOD met us more than halfway by upping the money to $3.5 million a year, allowing us to buy the Apache, the AHIP, the CH-47D and the Black Hawk. We are managing by that plan. We are adjusting from that plan as the Total Obligation Authority—TOA—declines, but at the present time, we have reserved enough money to arm the 243 AHIPs and continue to pursue LH.

Mr. McDADE. Last year, both the GAO and this Committee expressed concerns about lack of competitive LHX prototypes prior to selecting the winning contractor team.

Tell us why we shouldn't be concerned about that. Why shouldn't we require competitive prototypes?

Mr. SINGLEY. In the case of the LH, the light helicopter program, we have focused on the technology long poles in the tent, the technology challenges or barriers to going into full scale development. In 1981, almost ten years ago, there was a report called the vertical lift technology subgroup report which recommended that in the future, instead of over-relying on flight testing of prototypes, we need to take a less costly and a more productive approach in terms of making more extensive use of wind-tunnel simulations, component simulations, and component tests, as well as test beds and extensive use of system simulation.

In the case of the light helicopter program, we have done that. The light helicopter program has benefited from a number of past technology demonstrations. For example, the airframe technology has been proven out by virtue of the competitive program called the Advanced Composite Airframe Program where we demonstrated an airframe made of advanced composites. The engine technology has been demonstrated prior to going into FSD on the T-800 by virtue of our 1970's advanced technology demonstrator engine program.

We have made extensive use of crew station R&D simulation at NASA Ames and used extensively, systems integration labs to test all the avionics in the cockpit. So we feel that with the combination of the tech base work done, the demonstration validation efforts, the simulation and the wind tunnel efforts; the risk is in hand and we are ready to start full scale development.

Mr. CONVER. I would like to draw an analogy between our LH program and the ATF and the Navy ATA. These two fighter planes are two service aircraft. I think prototypes make a lot more sense in the case of ATF and ATA because in that instance we are pushing the envelope in aeronautical vehicles. We want to find out if the aircraft can perform aerodynamically and for that reason it makes a lot more sense to have a prototype for those.

The LX is the Army's comparable generation aircraft to the ATF and the ATA, but the challenge in the LH program is quite different. We know how to build helicopters and we know the helicopters can fly, so we don't feel that the prototype is as necessary with respect to the airframe. What we really don't know and where the real challenge lies in the LH program is getting the aircraft avionics, fire control and all the electronic systems integrated so that they can perform integrated with the man-machine interface, and that is the area where we see the primary challenge and that is the reason that the technology demonstrations we feel are important.

AIRCRAFT PROTOTYPING

Mr. McDade. We hear the same thing about the ATF, and that is why we are going the prototype route. We didn't do it on the B-1 and had a heck of a problem. Did we ever deliver a helicopter without getting a prototype first?

Mr. Singley. The Apache. We had a phase 1 and phase 2 program. Black Hawk, we went into development. In the case of our rotor craft programs, we have demonstrated the engines through a demo-engine program and we have demonstrated the pacing technologies through our tech demos so that we have the risk in hand before we start the full-scale development program.

Mr. McDade. This is a more complex machine than any helicopter you have ever bought.

General Pihl. That is true.

Mr. McDade. We recognize it adds dollars to your budget in a tough time to say we want prototypes, but we recognize that is a lot safer way to do the procurement.

I know you have some tough balancing acts to do—if you had your druthers, you would get the prototypes, wouldn't you?

Mr. Singley. If we had the funds, we would go with two competitive full-up prototypes. This way we have been able to maintain a competitive approach.

Mr. McDade. You would have that, too, if you were able to afford prototypes?

Mr. Singley. Yes, sir.

Mr. McDade. What is the current estimate of the cost of the prototypes?

Do you want to furnish that for the record?

Mr. Conver. In the range of $1.1 billion.

LH PROGRAM COSTS

Mr. McDade. It is not inexpensive. It is a judgment question.

We fully understand that any cost estimates on the LH this early in the program are at best fuzzy, but we would like you to share with us the numbers you use internally for planning purposes. Please tell us both constant and real dollars the following LH costs: total development cost, total production cost, and total program cost.

Supply those for the record.

[The information follows:]

The requested costs are shown below for the current program. The development costs include the T800 engine program. The contracts for the T800 engine program include strong price guarantees for all production supporting the Light Helicopter assuring an average unit cost of $248 thousand per engine (FY 1985$). Development costs cover the Fiscal Year 1984 through Fiscal Year 1997 time frame. Also included are Risk Reduction programs which have been completed. Production costs reflect a total buy of 2,096 aircraft produced at a rate of 216 aircraft per year. Total program costs add fielding and sustainment costs to the development and production estimates and assume each aircraft operates approximately 20 years.

[In millions of dollars]

	Constant dollars (1988)	Real dollars
Development	$3,212	$3,823
Production	23,745	38,849
Total program [1]	26,957	42,672
Unit Flyaway	7.5	

[1] Total Program includes development and production costs.

[Clerk's note.—On July 29, 1990, the Army submitted the following additional information:]

At the time of this hearing, March 15, 1990, the planning quantity was 1822. However, no cost estimate had been completed. Since then, the planning quantity has changed to 1875 at a peak production rate of 157 per year. Cost estimates for 1875 are as follows:

[In millions of dollars]

	Constant dollars (1988)	Real dollars
Development	$3,212	$3,823
Procurement	22,911	37,996
Total	26,123	41,819
Unit Flyaway	8.2	$13.6

LH INITIAL OPERATING CAPABILITY DATE

Mr. McDade. What is the latest initial operating capability estimate for the LHX, and how does this compare with your original estimate?

Mr. Conver. The IOC is December 1996, sir. I would have to ask someone—I know it was in 1995. I don't know the month, sir.

General Pihl. It has not slipped.

Mr. McDade. How many do you plan to buy?

General Pihl. One thousand eight hundred twenty-two, sir.

Mr. McDade. What would be the effect on the fiscal years 1991 through 1995——

General Pihl. That is a new number to you. Eighteen hundred is a new number from the 2,096 you see in our budget request. That is the effect of the drawdown of the aviation force.

Mr. McDade. So you are down 200 machines, are you?

General **Pihl**. That is correct.

EFFECT OF LH CANCELLATION

Mr. **McDade**. What would be the effect in the fiscal years 1991 through 1995 budgets if this program was canceled in 1991?

Put that in the record and please provide the data by fiscal year and by appropriation.

[The information follows:]

Light Helicopter (LH) funding in the Fiscal Year 1991 President's Budget for FYs 1991–1995 is as follows:

[Escalated dollars in millions]

	Fiscal year 1991	Fiscal year 1992	Fiscal year 1993	Fiscal year 1994	Fiscal year 1995
Appropriation:					
RDTE*	465	543	585	460	451
Procurement	0	13	189	341	1335
Total	465	556	774	801	1786

*Includes LH airframe/mission equipment and T800 engine.

This only reflects the LH program. The Army would be forced to fund additional RDTE and/or procurement programs to try to meet the critical requirements left unmet by cancellation of the LH program. These additional funds would be significant.

Mr. **McDade**. Thank you, Mr. Chairman.

Mr. **Wilson**. Mr. Miller?

TANK UPGRADE

Mr. **Miller**. Thank you, Mr. Chairman.

Sir, we heard a little while ago a lot of information concerning the M–1 and the upgrades that come after that. We were talking about the M–1 tank. We have the M–1 with Block II and, as I recall, the M–1 with Block III. The Army also has upgrades to the M–2.

Is that what I understand?

General **Pihl**. Yes.

Mr. **Miller**. Would you describe just what we are doing with each one of these?

What are the improvements that the Army is seeking? We undoubtedly are increasing capability and going along with new technology as to why the change—if it isn't the new technology, what is it?

General **Pihl**. Back in 1979, we pursued a combined arms team of the M–1 Abrams tank and the M–2/M–3 Bradley Fighting Vehicle. The Abrams has evolved through four stages now. We had the basic M–1 tank with the 105 millimeter gun. We built about 2,400 of those. We then improved the armor on that 105 millimeter gun tank and we built 894 improved M–1 tanks. We then cut in the M1A1 tank, which is where we upgunned the tank from 105 millimeters to 120 millimeters.

That is the current tank that is in production and when we finish the production in 1991, we will have built 7,847 M–1 tanks all total, against a requirement of about 10,000.

The Block II tank that Mr. McDade and I talked about is the upgrade to the M1A1 tank. It would become the M1A2. The A-2 tank would have a separate commander's weapon station, would have an upgraded armor package, positive navigation, avionics like computer processing and software inside the tank, put an airplane cockpit into the tank, and would have special armor protection upgrades. We are only going to produce a limited number in our current budget of about 62 of those tanks. That is the tank situation.

The Bradley Fighting Vehicle situation—we are going to continue to produce Bradleys because we have a mismatch now in the field. We don't have enough Bradleys to go with the tanks. We still have aluminum M-113 armored personnel carriers in the battlefield. So we will continue to buy Bradleys while we are building an upgraded M-1 tank.

The Bradley has had block improvements applied to it as well, mostly as a result of what we learned out of the live-fire tests at the Bradley Fighting Vehicle. The Block II upgrades take high, hard steel and stick more steel on the outside of the Bradley Fighting Vehicle so it can survive medium caliber munitions.

Mr. MILLER. On that particular vehicle that has more protection—is that provided by something that can be added to the vehicle in and on the battlefield?

General PIHL. In the case of the M-1 tank, we will increase the protection by changing the armor inside the vehicle. In the case of the Bradley Fighting Vehicle, we have no choice but to add or applicate it on to the basic chassis.

Mr. MILLER. Those are plates that would be attached to the vehicle?

General PIHL. That is correct.

Mr. MILLER. Thank you, Mr. Chairman.

Mr. WILSON. Mr. Livingston?

ANTI-SATELLITE (ASAT) PROGRAM

Mr. LIVINGSTON. Thank you, Mr. Chairman.

General, welcome.

Would one or all of you, Mr. Conver, explain the ASAT concepts that were proposed by each of the Services and why the Army's concept was selected?

Mr. CONVER. With your permission, I would like to ask Brigadier General Morgan Jellett, our ASAT Program Manager at Huntsville, to answer the question.

General JELLETT. We had at the time of the decision, the decision meeting in December, two proposals, one by the Joint Program Office, led by the Army, and a second proposal by the Navy. The Army's proposal with the Joint Program Office was a land-based system of a single site that essentially had 70 rounds to engage the threat as specified by U.S. CINCSPACE. The Navy proposal included basing the systems on the 963 Spruance class destroyer. They anticipated making modifications to sufficient numbers of ships to maintain 10 ships throughout, dispersed throughout the world, and essentially they would place the missile inside a vertical launch system tube.

The land-based system as designed by the Army had a larger rocket body. It was not constrained by the VLS tube, could reach the altitudes that were prescribed. The Navy system basically depended upon a proliferation of sites in order to accomplish the same mission, in order to negate the same number of targets, ——— that U.S. CINCSPACE had specified. They were going to need a larger inventory of missiles. Those facts, coupled with the decision to not cause a deletion of the capability of the ships in terms of their combat capability, by placing an ASAT system in a hole that could be otherwise used to provide force projection for the Navy, were to two critical factors in deciding that the Army should go ahead with a land-based system for the production of the ASAT.

Mr. Livingston. How much is budgeted in fiscal year 1991 for development of the Army's kinetic ASAT?

General Jellett. It is $207 million budgeted for 1991.

Mr. Livingston. How will those funds be used?

General Jellett. One hundred twenty million dollars of those would go to two contractors, $60 million each for the development of a full-scale development program over a 2 year period as well as the beginning of the technical or tactical design of the system. There is $32 million which we would use for preparing for a test vehicle so that we could have test flights by each of the contractors and a modification which the government would provide those two test vehicles as well as the range instrumentation. Those are the principal expenditures for that year.

Mr. Livingston. For the record, would you give us also the total development cost, the total production cost, the quantities and the total program cost for the kinetic system.

[The information follows:]

The best estimate for kinetic energy ASAT costs in escalated dollars is:

	Million
Research and development	$1,305
Production of 72 missiles	606
Total program cost	2,252

(Note: The total includes $341 million for operating and support costs over a 20 year life cycle.)

Mr. Livingston. Will testing be necessary against an object in space and, if so, when is this planned?

General Jellett. We do not plan on testing against an object in space until the very earliest of 1994. The proof of principle, if you will, of the ASAT system with the two contractors would fly against a point in space, but 1994 would be earliest that we would project firing against an object.

Mr. Livingston. While we are on this subject, to the best of your knowledge, give us the status of the Soviet's performance in this same field.

General Jellett. My recollection—and I don't have the specific points—I think I probably ought to provide that for the record.

[Clerk's note.—Classified insert removed.]

Mr. Livingston. I would refer you to an article written by General Piotrowski of the Air Force who said recently—I think it was a February article—that the Soviets, although may not have tested the entire system since 1982, send up their SL–11 boosters regularly.

They test those all the time. They test their docking system with the MIR all the time and they test explosives of all sorts all the time and that pretty well constitutes an ASAT?

General JELLETT. Yes, sir. That is correct. I believe that what you were asking were the specific effects of their testing program and I don't have those.

Mr. LIVINGSTON. You could amplify that for the record.

[CLERK'S NOTE.—Classified insert removed.]

ASAT DIRECT ENERGY (DE)

Mr. LIVINGSTON. Concerning the directed energy ASAT system, what is OSD's guidance?

General JELLETT. With the directed energy system, we have guidance from OSD. It is directed that the Army and the Air Force operate in parrallel directions proceeding to a Milestone 1 decision in December of 1991. The Army was directed to pursue the free electron laser technology. The Air Force was directed to examine technology of the Carbon Dioxide Iodine Laser—Coil—and the Exemer Laser.

At the present time, the two Services are proceeding to that Milestone 1 decision. We are operating under the auspices of a joint committee with which we share information so that when we arrive at the Milestone 1 decision, that we would be able to have a congruent program.

There is also the MIRACL laser program that the Department of Defense has as a directed energy test bed. This test bed in 1991—1990 is being upgraded to provide a test bed capability for the system that could be used to demonstrate an ASAT capability at a relatively low power.

Mr. LIVINGSTON. General, I would like to come back to this. I have a few more questions—I understand that Congressman Dicks has to chair a hearing, and I yield to him at this time.

REMARKS OF MR. DICKS

Mr. DICKS. Thank you.

General Pihl, I understand this will be the last time you will be testifying before this committee.

General PIHL. Yes, sir.

Mr. DICKS. I want to say how much I appreciated working with you in your career, both out at Fort Lewis and here, and commend you on an excellent job. I wish that a couple of things that we have worked on together would have come to fruition, but this budget is tough and we understand those problems.

General PIHL. Thank you, sir.

EFFECTS OF FUNDING REDUCTIONS

Mr. DICKS. When you were faced with the problems last year of the Reagan budget—it was $41 billion overall for R&D for all the services—and it came down to $36 billion? How did you make the reductions that were required with the number that you finally got from the Congress?

General PIHL. In terms of RDT&E in the Army, we went from $5.4 billion to $6 billion so we did not make cuts in our R&D base. We protected it.

Mr. DICKS. So you didn't have to make any cuts last year whatsoever?

General PIHL. We made cuts in procurement accounts. In fact, between 1990 to 1991, we have gone down $4 billion in our procurement authority.

Mr. DICKS. We are talking about the 1990 President's budget?

General PIHL. Yes, sir.

Mr. DICKS. Forty-one billion dollars was in President Reagan's budget and that came down to $36 billion. Five billion dollars was reduced.

How did you do that? How do you make those reductions?

General PIHL. Sir, in terms of the various bills and billpayer exercises we go through once we are given a reduction, we look at the total accounts within the Department. At the present time, we have direction to preserve the quality of the force to keep up readiness in terms of operating tempo, O&M, a direction to sustain the training so that you have a fully trained, worldwide, deployable Army, so in past years, R&D and procurement became the billpayer in those exercises.

Mr. DICKS. I understand the Army is very concerned about tech base; is that correct?

General PIHL. Yes, sir. We have protected our tech base. I have direction to plus it up two percent each and every year through the five year defense plan.

Mr. DICKS. It looks like the Congress is going to cut back defense spending from the levels in the Cheney budget again.

Obviously, Congress goes through and makes adjustments in various line items because of changed circumstances and that is a practice that occurs on an annual basis.

But if we then said that because of this budgetary situation, you have to cut ten to 15 percent out of this R&D budget, I assume you would presume us to give you that direction and then let you make the adjustments?

General PIHL. Precisely.

Mr. DICKS. What kind of things would you look at? What would be the low priority things that might fall out generally?

Mr. CONVER. I defer to the others of a specific answer, but in answer to the general question what we would prefer if we had to take another decrement was that it not be specified that the cut come from R&D. We would like to have the broadest possible latitude in terms of where to take the cut. I guess our first choice would be cutting the Department on an overall basis, would be the best choice. The next best choice would be tell us to cut the Army; and a next best choice would be to cut the Army acquisition.

We would prefer, given the choice that we have to cut Army acquisition—I think our clear preference for the past couple of years, I think, would continue. We would prefer to cut procurement rather than cutting the R&D. We went to that fourth step and said, "Okay, we are going to be very specific and tell you to cut R&D by 15 percent; where would you take it out of R&D?" That is a very specific question that I would prefer to delegate to my colleagues here, but I think we would like the broadest possible latitude for making any cuts.

General **Pihl.** As you look at our programs before you, we have three competitions ongoing, the modernization of the helicopter force, the modernization of the tank force, or the armored force, and the establishment of a deep-attack capability. By the time you reach 1997, all three of those are claims for a large share of the procurement budget.

If we were forced to have another cut, in my personal opinion—and this is the advice I would give—we would be very severely looking at giving up a capability. There is one-third of that internal contest within the Army that would have to be looked at hard for a give-up. So perhaps you might give up the entire deep-attack situation, ATACMS and JSTARS. If you did that in terms of the deterrence and war-fighting, you have an Army of the nineties and the year 2000 that fights from 40 kilometers into the forward line of troops, has no capability to influence the battle beyond 40 kilometers on out to the ranges where we think we need to fight.

Mr. **Dicks.** You see the changing situation in Eastern Europe. We have worried about the Warsaw Pact and the Soviets reinforcing that. With that situation changing, that ought to be one area that you might have to consider. I just wanted to get a general sense of this because frankly in my opinion, Congress is going to make cuts and we are going to have to look at all accounts and R&D is going to be one of them.

I appreciate the gentleman yielding. I have some other questions for the record. Thank you.

[Clerk's note.—Questions submitted by Mr. Dicks and the answers thereto follow:]

Question. As you know, the Congress is considering lower overall defense spending figures than currently proposed by the Department. If you were tasked to reduce fiscal year 1991 Army R&D by 10 percent in budget authority what type of options would you have to consider?

Answer. I first want to reiterate the Army's postion on budgetary cuts. The Department would like the broadest possible latitude on taking reductions. With that said, it is our perference to sustain R&D funding. However, if tasked to reduce the Army R&D budget by 10 percent, the Army would not reduce Backlog of Maintenance and Repair (BMAR) and would have to reduce the pace of modernization even further.

Question. What else would you have to look at if the cut were 15–20 percent?

Answer. After reductions against Backlog of Maintenance and Repair (BMAR) and modernization we would be forced to cut back our efforts in developing key technologies.

Question. Explain how you make decisions on which projects to proceed with through each step of the research and development, process.

Answer. Resources are applied to projects based upon priorities established by the Army. Each program is evaluated based on where it is in the Life Cycle System Management (LCSMM) process. LCSMM is a combination of activities, documentation and events/decision points within a basic framework of life cycle phases.

[CLERK'S NOTE.—End of questions submitted by Mr. Dicks.]

Mr. WILSON. Mr. Livingston.

ASAT DIRECTED ENERGY

Mr. LIVINGSTON. General Jellett, with respect to the ASAT Directed Energy system, how much is budgeted by the Army in fiscal year 1991 and how will these funds be used?

General JELLETT. In fiscal year 1991, $207 million—I am sorry, for the directed energy——

Mr. LIVINGSTON. Yes.

General JELLETT. We have $40 million budgeted in fiscal year 1991. Those will be used for modification and upgrade of the free electron laser to give us a full aperture capability to track through the aperture with their tracking devices so that we can actually track with that system against a target in space.

Mr. LIVINGSTON. Is that the Army plan or the Air Force plan and why are there two and why should they both be funded, General?

General JELLETT. That is the Army plan and I am afraid I can't speak to the Air Force program. I am not familiar with that.

Mr. LIVINGSTON. So if there are any redundancies, who should we see about that?

General JELLETT. We really have two programs that are running in parallel in terms of test beds to prove out the technology. They are looking at the Carbon Dioxide Iodine Laser—COIL—technology and we are looking at the free electron technology.

Mr. LIVINGSTON. It is still very much an R&D program; is that correct?

General JELLETT. Yes, sir.

Mr. LIVINGSTON. What requirements would be met by a directed energy system that cannot be met by a kinetic energy system?

General JELLETT. The systems are synergistic. With a directed energy system, you achieve a soft kill so you do not create debris hazard in space. It gives you the ability to blind or dazzle the satellite, perhaps rendering it inoperative for a period of time or perhaps making it inoperative for a longer period.

Once the system is designed and available, the number of shots that you can get off against a target are much cheaper with a directed energy system. It helps also in the discrimination of decoys. Should we have decoys employed, you can actually discriminate and go after the particular target.

Mr. LIVINGSTON. A kinetic energy system would just plow into its opponent, whereas the directed energy system could check it out first, determine what it is and kill it, if necessary?

General JELLETT. Yes, sir.

Mr. LIVINGSTON. I have some questions for the record, too. Thank you, Mr. Chairman.

[CLERK'S NOTE—Questions submitted by Mr. Livingston and the answers thereto follow:]

NATIONAL SCIENCE FOUNDATION

Question. Mr. Secretary, General, the National Science Foundaton projects a shortfall of 560,000 scientists and engineers by 2010. Can you tell this Subcommittee how this human resource shortage impacts the Army's research programs, labs, and, more specifically, your fundamental research (6.1 accounts) programs?

Answer. The Army, and the DoD at large, is extremely concerned about the national decline in U.S. student representation in science and engineering. The Army has participated in numerous studies with the Federal Government and DoD to address this subject; a recently prepared draft DoD report "Science and Engineering Education Activities of the DoD", articulates DoD concerns on this matter. In recognition and anticipation of the national decline in available science and engineering talent, and its potential erosive impact on the evolution of the Army research program, Army leadership has developed and implemented a competitive strategy to develop, attract, and maintain a science and engineering cadre to address Army-specific research requirements through orchestrated outreach programs.

The Army Research Office (ARO), in phase with in-house Army R&D laboratories, is continually developing and managing science and engineering programs with academia, with explicit provision for professional and student development through senior research sabbaticals to Army laboratories and student/post-doctoral fellowship programs, in focused Army-specific research thrust areas. Therefore, with continuity of objective and resources, vested long-term management commitment, and well-orchestrated top-down, bottom-up team work, the Army has the infrastructure, through ARO and the in-house laboratories, to meet the Army's future technology needs.

Question. Please quantify for the record what shortages the Army is experiencing in acquiring science and engineering graduate talent.

Answer. Notwithstanding current TDA and monetary resource constraints and the hiring freeze, there is no discernible shortage of science and engineering talent based on national availability.

Question. What specific programs does the Army have to address shortfalls in scientific and engineering personnel? Provide a breakout of programs by account and dollars as well as a brief explanation of each program.

Answer. The Army has a variety of programs which address the shortfalls in scientific and engineering personnel. The Army, of course, cannot change the overall demographics occurring in the United States, however, the Army continues to take a pro-active position to increase the supply of scientists and engineers with programs at the pre-college, and undergraduate level. A listing of such programs follows:

Summer high school faculty.—This program provides opportunity for science and math teachers to work and participate in research at various Army Laboratories. During FY 1989, 128 teachers participated in this program, funding was from Laboratory funds and totaled $543,000.

Research and engineering apprentice.—This program provides high school students interested in science and engineering to work with a mentor at a local university. The mentor receives partial funding for his participation. During FY 1989, 110 students participated and the program cost was $300,000 utilizing 6.5 funds from account M729.

Junior science and humanities symposium.—The Junior Science and Humanities Symposium conducts 43 regional conferences which consists of student papers, lectures, and tours. High School teachers are also in attendance. During FY 1989, 10,000 students participated and the program cost was $850,000 utilizing 6.5 funds from account M729.

Science and engineering fair.—The Science and Engineering Fair attracted approximately 100,000 students to 350 state and regional competitions. The Army provided awards for the best submissions. During FY 1989 this activity was funded at a level of $50,000, utilizing 6.5 funds from account M729.

Uninitiated introduction to engineering.—During FY 1989, 686 students participated in this program to introduce them to engineering through a 4 week program to improve their academic, computer and communications skills. The cost of this program for FY 1989 was $295,000 utilizing 6.5 funds from account M729.

Science and engineering ROTC co-op program.—The objective of this effort is to increase the number of scientifically trained officers in the Army. The program pays up to $5,000 for tuition, room, and board for selected ROTC participants. During FY 1989 the Army invested $133,000 in this program.

Question. Does the Army have graduate traineeship or fellowship programs for science and engineering? If so, provide details on funding and accounts that these programs fall under. If not, explain why.

Answer. The Army has two programs which support approximately 180 fellowships each year in science and engineering. Through its eleven URI centers run by the Army Research Office, approximately 160 fellowships are awarded to American citizens only. The centers provide the Army with research focused on areas critical to its needs. The Fellows trained under this program are, hence, providing a direct link to Army needs in the next century. The Army also provides twenty fellowships to outstanding students nation-wide through the National Defense Science and Engineering Graduate Fellowship Program which is also run by the Army Research Office.

This year, over 1,200 students applied for these fellowships. Of these, 300 were very highly qualified and deserved support; across the three services and DARPA, only 110 could be funded. Funds for URI fellows are provided through the URI (61103) account. The NDSEG fellows are funded through the URI account and ARO's 61102 (BH57) account (equally split).

Question. Provide for the record a breakdown by state, university, number and dollars the fellowships in science, engineering, and other areas that the Army has provided in each of the last five fiscal years.

Answer. The information follows:

ARO SUPPORTED FELLOWSHIPS ($K)

UNIVERSITY	ST	#	FY86	#	FY87	#	FY88	#	FY89	#	FY90
U. of Alabama-Birmingham	AL							1	22		
U. of Arizona	AZ	1	20	1	20	1	20	1	22		
Cal Inst of Tech	CA							2	80		
Stanford	CA							4	113		
U. of Cal - Berkeley	CA							2	64		
U. of Cal - Davis	CA							1	22		
UCLA	CA							2	44		
U. Cal - San Diego	CA	3	75	3	70	6	159	6	160	1	28
U. Cal - Santa Barbara	CA	1	32	1	32	1	32				
U. Southern Cal	CA	4	61	6	61	8	111	6	108	7	130
Colorado State U.	CO	11	240	11	229	14	312	13	303	8	188
U. of Connecticut	CT	1	18	1	18	1	18				
Yale	CT	1	20	1	20	1	20				
U. of Delaware	DL	8	168	8	168	8	181	8	184	5	118
U. of Florida	FL	2	40	2	40	2	40				
Emory U.	GA	1	20	1	20	1	20				
Georgia Tech	GA	1	20	1	20	1	20	1	22		
Northwestern	IL	5	10	5	10	5	10				
U. of Illinois	IL	17	358	17	350	17	349	16	336	7	188
U. of Kentucky	KY	1	19	1	19	1	19				
MIT	MA	16	341	16	337	18	392	21	455	24	509
MIT/Brown/Harvard	MA	18	365	18	269	17	352	17	357	15	244
U. of Massachusetts	MA	1	20	1	20	1	20				
U. of Maryland	MD	1	20	1	20	1	20	1	22		
Michigan Tech	MI	1	19	1	19	1	19				
U. of Detroit	MI	1	20	1	20	1	20				
U. of Michigan	MI	13	313	10	315	26	645	18	444	18	435
U. of Minnesota	MN	1	16	1	16	1	16				
Duke	NC	2	37	2	37	2	37				
NC State U.	NC	4	77	4	77	4	77				
U. of North Carolina	NC	2	33	2	33	2	33	1	22		
Princeton	NJ	1	20	1	20	1	20	1	29		
Stevens Inst	NJ	2	39	2	39	2	39				
Cornell	NY	13	311	11	311	18	429	8	202	7	187
Courant Inst of Math	NY	2	40	2	40	2	40				
Rensselaer	NY	2	40	2	40	2	40				
U. of Rochester	NY	21	478	21	478	21	523	22	434	18	532
SUNY at Albany	NY	1	20	1	20	1	20				
U. of Cincinnati	OH							1	22		
Drexel U.	PA	2	40	2	40	2	40				
Penn State U.	PA	1	19	1	19	1	19	2	46		
Brown	RI	1	20	1	20	1	20				
U. of Rhode Island	RI	1	18	1	18	1	18				
U. of South Carolina	SC							1	22		
Clemson	SC	2	38	2	38	2	38				
U. of Houston	TX	1	20	1	20	1	20				
U. of Texas - Austin	TX	1	17	1	17	1	17				
U. of Virginia	VA	1	19	1	19	1	19				
Virginia Polytech Inst	VA	1	20	1	20	1	20				
U. of Washington	WA							1	22		
U. of Wisconsin	WI	6	140	6	142	15	295	10	270	4	115

TOTALS*	#	FY86	#	FY87	#	FY88	#	FY89	#	FY90
	176	3663	173	3543	214	4562	166	3807	114	2674

NOTE: FY90 NDSEG Fellowships have not been awarded yet.

* Totals may not add due to rounding.

Question. As I understand, Dr. Bromley, this Administration's Chief Science Advisor, recently testified that we should develop programs, to address our science and engineering human resource shortage, that take into account the fact that 75% of our student attend their local or state colleges and universities. If additional funding were made available to the Army, would it make sense and be helpful to future Army research efforts to implement graduates science and engineering traineeship programs that would develop a broader national base for science and engineering talent?

Answer. Over the last several years, Army outreach programs with academia have covered a broad spectrum of research topics and have spanned nearly every state in the Union. No doubt, with additional funding for such programs, the Army would certainly enhance its ability to develop increased specialized training mod for science and engineering talent, and thereby developed a broader national talent base.

Question. What is the geographic distribution of the Army's URI and URI-RIP program awards? Provide this data by state and institution, inlcuding the number of awards by each state and institution and the dollar value breakdown for each.

Answer. The information follows:

ARMY URI FUNDING BY STATE

UNIVERSITY	ST	FY86	FY87	FY88	FY89	FY90
U. of California - San Diego	CA	841	569	427	996	865
U. of Southern California	CA	933	178	441	1297	1126
U. of California - Riverside	CA				110	71
Colorado State U.	CO	1481	790	1726	1688	1465
U. of Connecticut (RIP 89)	CT				49	54
Catholic U. of America (RIP 89)	DC				110	110
U. of Delaware	DE	1379	394	765	904	784
Florida Inst of Tech (RIP89)	FL				140	140
Atlanta U. (RIP 89)	GA				115	112
U. of Illinois-Urbana-Champaign	IL	1638	975	1794	1876	1628
MIT, Brown, Harvard	MA	1704	1334	1991	2514	2182
MA Inst of Technology	MA	1578	766	2174	2062	1790
U. of MD-Baltimore (RIP 89)	MD				75	75
U. of Michigan	MI	1557	999	3489	2578	2237
Michigan State U. (RIP 90)	MI					100
Michigan State U. (RIP 89)	MI				118	110
Michigan State U. (RIP 89)	MI				76	76
U. of Minnesota (RIP 89)	MN				80	91
U. of Missouri-Rolla (RIP 90)	MO					101
U. of North Carolina (RIP 90)	NC					200
U. of Nebraska-Lincoln (RIP 89)	NE				130	130
U. of Nebraska-Lincoln (RIP 89)	NE				60	59
Cornell U.	NY	1465	1111	2345	2365	2053
U. of Rochester	NY	2019	523	3303	2986	2592
Kent State U. (RIP 90)	OH					140
U. of Pittsburgh (RIP 90)	PA					140
U. of Texas-Arlington (RIP 89)	TX				130	110
U. of Wisconsin-Madison	WI	1358	640	2286	1833	1591
Marquette U. (RIP 90)	WI					134
West Virginia U. (RIP 89)	WV				57	39
Administration				133	149	91
ARMY RESEARCH PROGRAM TOTALS:					22498	20396
Graduate Fellowships					1250	1175
ARMY "PEOPLE PROGRAM" TOTALS					1250	1175
ARMY TOTALS:		15926	8279	20874	23748	21571

Question. Provide a breakdown in number and dollar value, and by state and institution, the basic research of 6.1 program grants or awards made by the Army to private or public entities for fiscal years 1987, 1988, and 1989.

Answer. The information follows:

STATE / SCHOOL	FY87	FY88	FY89
Alabama, Total	994,905	450,811	369,208
Alabama A & M University	50,000	55,811	57,255
Auburn University	300,000	300,000	72,000
Tuskegee Institute	474,500		
Univ Alabama Birmingham			66,000
Univ Alabama Huntsville	170,405	95,000	173,953
Univ of Montevallo			
Alaska, Total	0	0	144,952
Univ of Alaska Anchorage			
Univ of Alaska Fairbanks			144,952
Arizona, Total	1,507,843	886,730	1,102,271
Arizona State University	480,995	268,694	490,998
University of Arizona	1,026,848	618,036	611,273
California, Total	13,990,698	10,390,955	12,174,849
Calif St Univ Fullerton		40,000	
Calif St Univ Long Beach			13,750
Calif St Univ Northridge		75,049	40,677
California Inst of Tech	1,220,404	1,132,910	1,195,993
San Diego State Univ			797
Stanford University	4,860,824	3,421,626	3,897,757
Univ of Cal Berkeley	975,200	624,802	862,403
Univ of Cal Davis	79,321	3,160	86,000
Univ of Cal Irvine	643,176	322,929	478,802
Univ of Cal Los Angeles	1,235,278	516,892	732,120
Univ of Cal Riverside			111,028
Univ of Cal San Diego	1,509,867	2,012,171	1,576,396
Univ of Cal Santa Barbara	1,682,591	757,145	967,801
Univ of Southern Cal	1,784,037	1,484,271	2,211,325
Colorado, Total	2,489,815	3,393,327	2,100,370
Colorado School of Mines	472,999	197,046	128,141
Colorado State University	1,224,804	2,154,439	1,688,010
University of Col - Boulder	792,012	1,041,842	284,219
Connecticut, Total	1,881,032	729,422	682,984
University of Connecticut	755,921	308,040	383,476
Yale University	1,125,111	421,382	299,508
Delaware, Total	677,182	794,634	1,163,146
University of Delaware	677,182	794,634	1,163,146
District of Columbia, Total	359,899	135,047	365,987
Catholic Univ of America			109,987
George Washington Univ	126,997	135,047	85,000
Howard University	232,902		171,000

STATE / SCHOOL	FY87	FY88	FY89
Florida, Total	868,675	989,635	1,023,241
Florida A & M University			49,999
Florida Atlantic Univ	79,959	52,056	52,670
Florida Inst of Tech			140,000
Florida State University	76,604	163,991	
University of Central Florida	51,877	38,000	
University of Florida	660,235	600,524	692,824
University of Miami		135,064	87,748
Georgia, Total	2,385,642	3,080,389	3,211,264
Atlanta University		363,109	184,125
Emory University	215,837	239,744	195,241
Georgia Institute of Tech	1,810,817	2,391,822	2,815,244
Georgia State University	46,697	50,714	16,654
University of Georgia	312,291	35,000	
Illinois, Total	4,505,725	4,685,918	4,012,916
Illinois Inst of Tech	50,790	10,000	30,000
Northern Illinois Univ		18,967	
Northwestern University	516,116	178,215	120,000
Southern Ill Univ Sys Off	74,026	8,250	
Univ of Ill Chicago	621,986	540,780	457,795
Univ of Ill Urbana	3,159,112	3,929,706	3,405,121
University of Chicago	83,695		
Indiana, Total	969,579	745,891	706,238
Indiana University	165,691		
Purdue University	607,888	745,891	706,238
University of Notre Dame	196,000		
Iowa, Total	47,500	79,029	176,855
Iowa St U of Sci & Tech	47,500	31,261	45,000
University of Iowa		47,768	131,855
Kansas, Total	410,700	344,257	432,569
Kans St U - AG & App Sci	225,700	187,933	231,677
University of Kansas	185,000	156,324	200,892
Kentucky, Total	122,405	118,061	286,349
University of Kentucky	122,405	118,061	286,349
Louisiana, Total	305,322	463,322	171,501
Louisiana State Univ	120,960	303,000	40,000
Southern U & A&M College	101,466	101,466	
University of New Orleans	82,896		78,000
Xavier University of LA		58,856	53,501
Maryland, Total	1,490,362	1,505,652	1,290,405
Johns Hopkins University	208,884	292,797	177,590
Morgan State University	40,000		
Univ of MD College Park	1,241,478	1,212,855	1,112,815

STATE / SCHOOL	FY87	FY88	FY89
Massachusetts, Total	8,232,135	9,709,515	10,184,081
Boston College		60,000	
Boston University	770,732	550,067	487,017
Brandeis University			61,586
Clark University	45,423		
Harvard University	480,426	227,183	166,144
Mass Inst of Technology	5,119,816	7,455,606	8,376,679
Northeastern University	265,792	101,554	116,960
Tufts University	141,103	115,000	167,497
Univ of Mass at Amherst	1,408,843	1,200,105	717,458
Worcester Poly Institute			90,740
Michigan, Total	2,368,750	5,817,611	4,628,233
Michigan State University	85,744	437,096	293,597
Michigan Tech University	120,496	33,984	
University of Detroit	20,000	20,000	
University of Michigan	1,944,775	4,821,296	3,718,161
Wayne State University	197,735	502,235	616,475
Western Michigan University		3,000	
Minnesota, Total	828,144	606,724	567,147
University of Minnesota	828,144	606,724	567,147
Mississippi, Total	65,000	0	359,588
Jackson State University			263,824
Univ of Southern Mississippi			470
Univ of Mississippi	65,000		95,294
Missouri, Total	355,617	391,774	287,770
Univ of Missouri Columbia	119,755	274,419	221,683
Univ of Missouri Kansas City	110,263	37,355	
Univ of Missouri Rolla	125,599	80,000	66,087
Montana, Total	0	50,430	8,400
Montana State University		50,430	8,400
Nebraska, Total	357,367	333,895	565,528
Univ of Nebraska-Lincoln	357,367	333,895	565,528
Nevada, Total	3,500,000		
Univ of Nevada Las Vegas	3,500,000		
New Hampshire, Total	60,000	297,361	65,520
Dartmouth College		181,760	
Univ of New Hampshire	60,000	115,601	65,520
New Jersey, Total	1,841,250	1,593,368	1,358,687
Princeton University	1,442,493	1,116,134	1,077,914
Rutgers the St Univ of NJ	220,510	290,945	206,550
Stevens Institute of Tech	178,247	186,289	74,223
New Mexico, Total	684,846	1,215,003	276,086
New Mexico State Univ	552,684	1,110,890	192,218
University of New Mexico	132,162	104,113	83,868

STATE / SCHOOL	FY87	FY88	FY89
New York, Total	11,568,134	14,956,413	14,264,280
Clarkson University	187,623	139,295	115,350
Columbia Univ Main Div	1,069,679	893,108	893,500
Cornell University	4,934,923	6,822,445	6,278,326
CUNY Brooklin College	74,999	75,000	
CUNY NY City Tech Col	90,305	100,000	310,000
New York Inst Technology	112,200		
New York University	179,993	333,761	247,457
Polytechnic Inst of NY	266,824	181,869	156,339
Rensselaer Polytech Inst	1,582,619	1,783,554	1,576,610
SUNY at Albany	174,835	71,347	369,974
SUNY at Binghamton	43,699		74,761
SUNY at Buffalo	367,656	149,156	311,070
SUNY at Stony Brook	364,151	135,642	346,644
Syracuse University	220,723	319,105	200,016
University of Rochester	1,897,905	3,952,131	3,384,233
North Carolina, Total	2,490,786	4,164,025	2,697,804
Duke University	817,002	1,276,227	1,100,150
East Carolina University	32,670	58,631	60,342
NC State Univ at Raleigh	1,177,279	1,983,637	993,855
NC AS & Tech State Univ	20,000	195,986	333,982
North Carolina Cntrl Univ	100,678	41,443	
Univ of NC at Chapel Hill	343,157	608,101	209,475
Ohio, Total	1,638,139	1,413,891	1,572,096
Case Western Reserve Univ	526,092	365,577	377,374
Ohio State University	650,325	294,542	333,521
University of Akron	56,050	78,683	426
University of Cincinnati	225,672	119,662	225,599
University of Dayton	180,000	555,427	635,176
Oklahoma, Total	554,794	360,528	574,796
Oklahoma State University	277,750	285,528	430,526
University of Oklahoma	277,044	75,000	144,270
Oregon, Total	208,468	18,581	279,980
Oregon Graduate Center	208,468		
Oregon State University		18,581	79,980
Portland State University			200,000
Pennsylvania, Total	5,115,796	4,239,746	3,209,373
Carnegie-Mellon Univ	519,831	477,290	280,414
Drexel University	215,000	128,549	84,215
Duquesne University		62,295	
Lehigh University	130,000	130,000	177,320
Pennsylvania State Univ	1,691,855	1,263,158	1,249,715
University of Pennsylvani	1,975,901	1,984,800	1,082,700
University of Pittsburgh	583,209	193,654	335,009
Rhode Island, Total	2,269,581	1,916,948	1,378,446
Brown University	1,918,171	1,382,340	1,115,018
Univ of Rhode Island	351,410	534,608	263,428

STATE / SCHOOL	FY87	FY88	FY89
South Carolina, Total	332,536	464,790	296,020
Clemson University	210,882	275,052	98,020
University of South Carolina	121,654	189,738	198,000
Tennessee, Total	201,000	88,999	329,648
Meharry Medical College		68,175	184,385
University Tennessee Knoxville	85,000	20,824	34,000
Vanderbilt University	116,000		111,263
Texas, Total	3,398,950	4,147,368	2,865,637
Baylor University	23,392	23,394	
North Texas State University	552		
Pan American University			76,542
Rice University	183,762	576,949	87,500
Southern Methodist University		255,000	59,372
Texas A & M University	516,546	212,152	178,109
Texas Tech University		147,179	
U of Houston Univ Park	583,125	353,561	256,069
Univ of Texas at Arlington	75,393	20,000	190,000
Univ of Texas at Austin	1,959,610	2,417,464	1,671,370
Univ of Texas at Dallas	56,570	141,669	181,500
Univ of Texas at El Paso			165,175
Utah, Total	714,577	382,143	265,958
Brigham Young University		110,000	
University of Utah	714,577	272,143	265,958
Vermont, Total	102,529	0	478
Univ of Vt & St Agric Col	102,529		478
Virginia, Total	1,993,462	1,284,472	1,124,129
George Mason University	174,000	71,041	75,000
Hampton Institute	504,232		
Norfolk State University	396,180		
Old Dominion University	199,968	219,903	79,961
University of Virginia	534,457	583,715	504,073
VA Polytech Inst & St U	108,625	314,325	365,608
Virginia Commonwlth Univ	76,000	95,488	99,487
Washington, Total	824,068	371,533	321,472
University of Washington	477,474	346,533	321,472
Washington State Univ	346,594	25,000	
West Virginia, Total	400	0	55,811
West Virginia University	400		55,811
Wisconsin, Total	1,604,243	3,307,548	2,664,142
Univ of Wisconsin-Madison	1,604,243	3,307,548	2,562,844
Univ of Wisconsin-Milwaukee			101,298
Wyoming, Total	47,000	134,396	0
University of Wyoming	47,000	134,396	
Puerto Rico, Total	115,852	0	157,934
Univ of PR-Mayaguez			78,982
Univ of PR-Rio Piedras	115,852		78,952

Question. Provide for the record the statutory and regulatory authority for the URI and URI-RIP programs.

Answer. The Army receives statutory and regulatory authority for the URI and URI-RIP programs annually through the budget Authorization and Appropriation legislation.

NUTRITION RESEARCH

Question. Several years ago this Subcommittee initiated $3.5 million in funding to the Army for nutrition research at the Pennington Biomedical Research Center at Louisiana State University. Has the Army been satisfied with the work performed to date by the LSU and the Pennington Center?

Answer. The Army has been satisfied with the research support and information products which have resulted from this grant. However, the enthusiasm for the work is tempered by the fact that the congressional directive for the Army to fund this grant caused a dramatic, unprogrammed increase in the level of support given to military nutrition research at the expense of other ongoing studies. This unexpected funding requirement necessitated adjustment in the timing and execution of other medical research programs supported by the U.S. Army Medical Research and Development Command.

Question. Describe briefly the work and projects developed by the Army and the Pennington Center and their importance to Army readiness and preparedness.

Answer. Five projects have been approved for execution under the terms of this grant. The first two projects focus on the creation and operation of analytical laboratories at the Pennington Research Center; one for clinical chemistry, and one for the analyses of stable isotopes. These laboratories are now providing critical analytical support for both the Pennington Center and the military nutrition research projects conducted by the U.S. Army Medical Research and Development Command.

The other three projects are a study of diet, neurotransmitters and behavior; a "Heart Smart" study at Fort Polk; and a Fort Polk Menu Modification project. The first of these three projects has been particularly productive and has resulted in four publications in the scientific literature. The Fort Polk project is nearing completion and has received enthusiastic support from the Fort Polk community. The menu project is only one-half completed but has resulted in the reduction of the fat content of the Fort Polk dining facility.

While there is usefulness from the five projects, the importance to readiness and preparedness is not readily apparent. The grant is entitled "Effect of Food, Diet and Nutrition on Military Readiness and Preparedness of Army Personnel and Dependents in a Peacetime Environment". The mission of the U.S. Army Medical Research and Development Command does not include nutrition education and health promotion among Army personnel or dependents.

Question. Provide details on the funding spent to date and future funding plans (including FY 1992 and beyond) of the Army for the Pennington Center.

Answer. The terms of the grant with the Pennington Biomedical Research Center, Louisiana State University, is from 28 July 1988 through 27 July 1991. The total funding for this grant ($3.5 million dollars) was dispersed in fiscal year 1988. There are no specific plans to fund the Pennington Center in the future.

Question. What are the Army's future plans (provide the program and funding details) for diet and nutrition research, education and promotion for our Army personnel?

Answer. For fiscal year 1992 and beyond, the funding for U.S. Army Medical Research and Development Command is uncertain but is expected to be seriously constrained, just as is anticipated for other Federal agencies. The level of support which the Army will be able to commit to grants and contracts will be dependent upon the priority established for research funding. At the present, the most that could be expected for a grant to support nutrition research would be approximately $100,000 per year for fiscal years 1992 through 1995. This funding would be placed in support of the research programs in military institutes and laboratories. The mission of the U.S. Army Medical Research and Development Command does not include nutrition education and health promotion among Army personnel or their dependents.

BALLISTIC RESEARCH ON CATS

Question. Has the Army terminated funding (pursuant to Public Law 101-165) for Army contract #DAMD17-86-C-6098?

Answer. Public Law 101-165 does not call for terminating the contract. It prohibits payments until thirty days after the Government Accounting Office has submitted its final report to the Committees on Appropriations. To date, no report has been submitted.

The Army is in compliance with the Public Law and has been unable to meet its contractual obligations to the Louisiana State University. Maintenance of the animals, payment of salaries, analysis of data, and preparation of scientific reports can not be paid. The findings from the study are being wasted because of the dilemma. Although the contract remains in effect, no funding has been released since 13 November 1989.

Question. Have any fiscal year 1990 funds been allocated or obligated to Louisiana State University for this contract? Explain.

Answer. No, the Army is in compliance with Public Law 101-165 which prohibits payments to the university until both Committees on Appropriation fully review the final Government Accounting Office report and approve in writing to the Department, the continuation of any funding for this contract. A draft report is due to Congress during May 1990.

LAMP-H PROGRAM

Question. Would you explain for the record the unique capabilities of the LAMP-H.

Answer. The LAMP-H Heavy Lift Amphibian is the only amphibian watercraft capable of transporting cargo in excess of 60 short tons (e.g., the M-1 Abrams Tank) from cargo ships to shore in those areas of the world where commercial ocean ports are inadequate, unavailable or denied. The LAMP-H is capable of transversing 96% of the beaches worldwide as compared to less than 26% for conventional displacement landing craft such as Landing Craft, Utility (LCUs). The LAMP-H typifies the versatility and uniqueness we are planning for the future Army.

Question. Testimony presented last year to Congress explained the importance of LAMP-H to operations in areas other than Europe, such as Southwest Asia. In view of the continuing situations in Southwest Asia, Central and South America, is the LAMP-H capability still important to the Army in these areas and others?

Answer. Yes. The LAMP-H provides strategic logistical support for offload and resupply transportation in support of Joint Logistics-Over-the-Shore (JLOTS) operations for areas without port facilities or where facilities are underdeveloped or destroyed. While the LAMP-H is still required for Southwest Asia (SWA), it is especially suited for Third World countries, and is required to transport heavy loads as well as smaller equipment and supplies to beaches where gradients and bottom conditions preclude the use of displacement craft. The need for LAMP-H has been reemphasized by the United States Army Forces Command (FORSCOM), the United States Central Command (CENTCOM), the United States Transportation Command (USTRANSCOM) and the Joint Chiefs of Staff.

Question. Given the rapidly changing world situation and projected impacts on our defense budget and force structure, do you still believe the LAMP-H will be important to the productivity and effectiveness of our soldiers performing the Logistics-Over-the-Shore (LOTS) mission?

Answer. Yes. The joint service requirement to offload ships at anchor and to move cargo across beaches and through underdeveloped or destroyed port facilities remains just as important today as it ever has. The Army Joint Logistics-Over-the-Shore (JLOTS) program has identified a variety of lighter and causeway systems required to reach the Army's JLOTS requirements. Selection of the needed equipment depends on many factors. Sea state and beach gradients are significant factors used to determine the mix of equipment needed to successfully accomplish a JLOTS operation in a specific situation. Studies by the Naval Coastal Systems Center have validated that only an air cushioned amphibian can be relied on to successfully execute the JLOTS mission in the vast majority of potential sites.

Question. Could you compare briefly the LAMP-H strategic beach and terrain capability versus other and current LOTS equipment?

Answer. Beaches suitable for LOTS operation and accessibility by craft type:

[In percent]

	SWA	World
Air cushioned vehicle	90	96
Landing craft, utility	7	6
Landing craft, mechanized	12	8

AIR-CUSHIONED VEHICLE (ACV) CAPABILITIES

	LACV-30	LAMP-H
M1A1	No	Yes
Bradley	No	Yes
140-T crane	No	Yes
Rough terrain container handler	No	Yes
M915/M872 tractor trailer	No	Yes
40-ft container	No	Yes
20-ft container	Yes	Yes

[CLERK'S NOTE.—End of questions submitted by Mr. Livingston.]

ERINT PROGRAM

Mr. WILSON. I wanted to ask about the anti-missile missile.

Do you know anything about that?

General PIHL. ERINT is being pursued by the Army Strategic Defense Command, which is a component of SDI. It is General Monahan's budget. I know enough about it to be conversant with the potential technology spinoffs, which is General Jellett's ASAT program. We are one-third of the SDI process. We have Lieutenant General Hammond who manages that for General Monahan.

Mr. WILSON. Isn't it possible that will spin off into a point air defense?

General PIHL. It could in terms of Tactical Missile Defense, and we are looking at SDI to help us with the TMD problem. Where you try to knock a re-entry vehicle out of the sky as it is coming into target.

Mr. WILSON. Couldn't it also have a potential against aircraft?

General PIHL. Aircraft and maneuvering re-entry vehicles; yes, sir. As we look to go beyond the Patriot PAC-2 capability in terms of tactical missile defense, there are technologies being worked by SDI, as well as by the Army for a true tactical missile defense system and we are going to try to bring that on after Patriot PAC-2.

Mr. WILSON. Do you know if there was some interruption in the program last year because of committee actions?

General PIHL. I don't know, but I would be happy to submit it for the record.

[The information follows:]

A minor interruption occurred in one particular Army project, that PATRIOT Multi-Mode Seeker Demonstration, when the Senate Appropriations Committee, in May 1989, directed the Defense Department not to obligate funds until the committee had the opportunity to evaluate the project. The committee evaluated the project and granted obligation authority with little delay; consequently, the inquiry had no adverse impact on the project's schedule.

Mr. WILSON. Mr. Sabo.

Mr. SABO. I will pass.

Mr. WILSON. Mr. AuCoin.

ASAT CAPABILITY BRIEFING

Mr. AUCOIN. Thank you, Mr. Chairman.

General Jellett, on ASATs, let me have your testimony.

It is good to see you again. Mr. Livingston and I both appreciated the briefing you gave us in Alabama last week.

Have you had access to the CIA briefing with regard to Soviet ASAT capability?

General JELLETT. No, sir. The information that I am familiar with is only that from the DIA information that was available to me while I was inside the mountain.

Mr. AUCOIN. So when you describe the Soviet ASAT capability, you are not drawing upon the briefing that the CIA can provide?

General JELLETT. No, sir.

Mr. AUCOIN. And could provide for all members of this committee?

General JELLETT. That is correct, sir. I am not.

Mr. AUCOIN. Mr. Livingston, in his questions for you, quoted General Piotrowski on the Soviet ASAT capability and he talked about the things that the Soviets have done, use of booster, use of explosives, docking with other devices in space.

It is the General's feeling—and I take it that my friend from Louisiana has the same opinion—that that is what it takes to have an ASAT.

If that is what it takes to have an ASAT, are you willing to have that be what it takes to have an American ASAT?

General JELLETT. I think, sir, that the Soviets—and I am aware that they have tested the system ——— the exact results of those, to the best of my knowledge, they had ——— of those that were successful.

In terms of our assessment——

Mr. AUCOIN. Are you talking about the sytem that has gone untested for the last seven years?

General JELLETT. Yes, sir.

Mr. AUCOIN. I am referring to what General Piotrowski is saying in terms of new alleged ASAT capability.

Is that the same system?

General JELLETT. It is the same system. The point that I would like to make is that they have taken the system through a series of testing and hence have made a determination—an assessment that the system has operation and then subsequently have demonstrated the various components of that, I think, which is General Piotrowski's point in terms of satisfying that they still have that ongoing capability.

Mr. AUCOIN. Testing pieces of a system separately rather than integrated full-up way is not the normal method by which high reliability tests are arrived at, though; isn't that correct?

I mean, you do have testing background?

General JELLETT. Yes, sir.

One would expect that you would want to continue testing it in a fully operational configuration, but again, if all the subelements are there and you had sufficient reliability, that I suppose could be a decision that one might make and for what reason, I don't know, why the Soviets have not done that.

Mr. AUCOIN. With regard to the reliability of a system that is now allegedly being tested component by component and not in an integrated end-to-end way, the reliability of that system, based on successes and failures, ———.

General **Jellett**. ———.

[**Clerk's note**.—Subsequent to the hearing, Mr. AuCoin asked for additional information. The answer thereto follows:]

Question. History shows that weapons in their first combat generally don't do nearly as well as they did in test. Now we have the Soviet co-orbital ASAT which failed ——— of its total tests with radar guidance, which failed its last test, and which hasn't been tested all-up for 8 years. In that light, please explain what you mean by ———. Do you mean that if we had a war today and they fired 10 of these ASATs, you expect them to take out ——— of our satellites? This would be doing better than they did in their peacetime test series of which the last one failed and none have occurred for 8 years. Please explain why you believe they would get such astonishingly high performance.

Answer. The Soviet co-orbital ASAT system with the radar sensor has demonstrated a success rate of ———. In terms of the question posed, the demonstrated failure rate of the co-orbital ASAT with radar guidance is ——— not ———. If you were to include those co-orbital launches with the developmental terminal homing sensor, then ——— is the demonstrated rate of failure. A ——— operational effectiveness rate means that for each engagement of a satellite by the Soviet ASAT, there is a ——— probability of killing that satellite. If the Soviets were to fire 10 ASATs at our satellites, we would expect ——— of our satellites to be taken out. This performance equates to their demonstrated results during testing. In reference to the failure rate, history has shown that the Soviets use systems that are well demonstrated and usually use them in large quantities. There is no evidence to support the supposition that the Soviets are changing tactics that have proven successful in the past. Therefore, it may be assumed that the Soviets would go with the proven ASAT system if its use were required today. The Soviets have continued to maintain their ASAT in an operational condition. They ——— continue to use the SL-11 (co-orbital launch vehicle) to launch other satellites. This activity, coupled with refining docking maneuvers for their space station, ensures their continued exercise of the intercept logic necessary for a co-orbital ASAT fill. The Soviets maintain a surge launch capability which would allow them to make up in quantity what they lack in quality.

Mr. **AuCoin**. You told us in Huntsville that you have a testing background. Would you regard that percentage as being a robust reliability percentage?

General **Jellett**. From a U.S. standpoint, I think we would like to have system reliability.

Mr. **AuCoin**. Higher rates?

General **Jellett**. Yes, a higher percentage but I think I would also point out that the success or failure rate that has been ascribed to those tests are ones that we have ascribed and not necessarily the success or failure rate the Soviets have ascribed, and therefore, a particular failure viewed from our standpoint might have been a success from their standpoint.

Mr. **AuCoin**. Here is where the CIA briefing I think is enormously valuable and the DIA briefing as well.

Mr. **Wilson**. I was just going to say, if a bear is coming at you, it is better to have a ——— chance of hitting them than none.

Mr. **AuCoin**. You are developing the kinetic kill, low-orbit ASAT. I want to ask you this question. Would a more powerful booster be all you would need to turn that into a geosynchronous orbit ASAT? A more powerful booster?

General **Jellett**. A more powerful booster, probably at least six or seven times more powerful in order to get it to a geosynchronous orbit would be something that would be required.

Mr. **AuCoin**. If you did that, you could get to those altitudes?

General **Jellett**. Yes. Whether the seeker would perform at those altitudes in that environment, because that is a much higher flux environment at that altitude, we would have to test that.

MIRACL TESTING

Mr. **AuCoin**. Regarding the MIRACL test, your testimony was that it won't be until 1994 that tests are planned against an object in space. That was the kinetic?

General **Jellett**. Yes, sir. We do not plan at the present time, testing against an object in space with MIRACL.

Mr. **AuCoin**. You are actually with MIRACL thinking about testing against an atmospheric drone?

General **Jellett**. That is correct.

Mr. **AuCoin**. Why did you make that decision?

General **Jellett**. For a number of reasons. I think in the normal progression of testing, we wanted to demonstrate its operational capability and build it up through space. We can by scaling factors measure to a degree its performance at a higher altitude. We ultimately would like to test against an object in space.

Mr. **AuCoin**. What are the dates for those tests?

General **Jellett**. The system will not be operational until March of 1991, at which time we will then begin the testing and would foresee testing through fiscal year 1991. I don't have specific dates for those drone tests.

Mr. **AuCoin**. What do you mean by operational? Are you talking about an operational ASAT in 1991?

General **Jellett**. No. I am talking about a capability that allows the system to be employed as a test bed.

Mr. **AuCoin**. General Pihl, can you make a firm commitment to the Congress right now that you will not test MIRACL against an object in space without prior approval reprogramming?

General **Pihl**. Yes, I can, sir.

Mr. **AuCoin**. In fiscal year 1991 you will not?

General **Pihl**. We will not test an object in space without approval.

Mr. **AuCoin**. Are you planning to test against an object in space in fiscal year 1991?

General **Pihl**. No.

Mr. **AuCoin**. How effective would ASAT with MIRACL be?

General **Jellett**. There are a number of constraints. First of all, one would have to employ the MIRACL as presently configured in what we call a terminator mode; that is, within an hour on either side of daybreak and an hour on either side of sunset where the satellite, the target is illuminated by the sun and your background then is dark. That is a signal-to-noise ratio and a particular problem unique to the way the MIRACL is constructed.

We have concerns with weather, not being able to operate in weather. We have to still overcome the technical problems of beam compensation and tracking through space, projecting that beam without a blossoming effect and heating the atmosphere so that we can bring sufficient destructive energy on the target. So with those you are looking at essentially a research and development facility of which in order to charge the MIRACL and allow it to fire, you can fire once every 24 hours. So in terms of an operational capability to take out specific satellites, I would call it extremely limited.

Mr. **AuCoin**. I think it is limited too. I was going to ask you about how many shots, over what period of time, once every 24 hours is what I understood also. Wouldn't you have to fire directly above the site?

General **Jellett**. You do have to fire within line of sight and directly above is probably better.

Mr. **AuCoin**. And the probability of kill is based on the fact that the target would not maneuver, isn't that correct? If there was a maneuvering capability in the satellite, the MIRACL would not work?

General **Jellett**. Yes. In this case, whether or not we would have the actual beam steering and the ability to make noise adjustments for a maneuvering target at that altitude, we would have to go back and take a look at it. We are looking at a fairly smooth tracking target.

Mr. **Wilson**. We need to wrap it up, Mr. AuCoin.

Mr. **AuCoin**. Absolutely.

Mr. **Wilson**. Mr. Sabo?

AIDS RESEARCH

Mr. **Sabo**. I am curious about the AIDS research question. I notice you have somewhat of a decrease from what we appropriated last year. I think that has been one of those congressional addons, but still you are cutting it by $11 million.

Will that sustain last year's program?

Mr. **Singley**. Yes, sir, it will. In fact, as you have pointed out over the last few years we have been plussed-up by the Congress around the neighborhood of $33–34 million.

The Army this year—in part because of the promising results of the research to date, has included in its 1991 budget request $22 million.

Mr. **Sabo**. As I recall, this was done outside the country, wasn't it?

Mr. **Singley**. We have cooperative researchers that we deal with. In fact, the recent GP–160 vaccine looks very, very promising. That was done in part, through cooperation with a private scientific firm, yes, sir.

Mr. **Sabo**. I notice that one of the things you are looking at is a model to track the financial impact of AIDS on active-duty personnel. Have you started that yet?

There was a recent GAO report that estimated $3 billion cost over the next decade?

Mr. **Singley**. Yes, sir. Over the next decade, our estimate is it could amount to as much as $3 billion. However, the research which we think will offer us an opportunity to make a significant dent in that cost, will require about one half of that amount over the course of the decade.

Mr. **Sabo**. I didn't follow the answer.

Mr. **Singley**. We estimate over the next decade the cost to DOD of HIV and AIDS-related health costs and associated training will run as high as $3 billion unless we are able to make more significant progress in terms of development of a vaccine. We have already made tremendous progress in terms of having a significantly more reliable screening test to keep individuals out of active duty that are HIV-infected. So through the vaccine work, through improved behavioral research and lower false rate, higher accuracy screening test, we hope to make a major reduction in that $3 billion figure.

Mr. **Sabo**. But it is a growing problem?

General **Pihl**. It is a readiness problem.

Mr. **Singley**. I have some numbers on it. Over the last year we have screened out 800 potential recruits, and made about $200 million in savings.

General **Pihl**. Screened out.

Mr. **Sabo**. What about folks who are currently in?

Mr. **Singley**. That is where our testing, of course, when you take a physical you get tested, and our higher accuracy testing results are going to pay dividends.

General **Pihl**. They are not allowed to be forward deployed. They are kept in the Continental United States, and we continue to care for them as long as they are on active duty.

Mr. **Singley**. In the past two years there is a 50 percent reduction in incidence going from 7.4 per thousand per year down to 3.7.

Mr. **Sabo**. Is that among enlistees?

Mr. **Singley**. That is the total.

Mr. **Sabo**. Do you have a breakdown for enlistees?

Mr. **Singley**. I can provide that.

[The information follows:]

Currently, ninety percent of HIV infected soldiers are enlisted personnel.

For the CY 1989, 1.0/1000 military applicants tested HIV positive at the MEPS.

At any one point in time, approximately 0.8/1000 active duty soldiers are HIV positive (source: Reportable Disease Data Base). It is important to note that the MEPS data base and active duty Army data base are not constructed in identical form and are therefore not comparable. Hence, it is not appropriate to compare data generated by these separate entities.

The military is the only source of screening data. No data base exists for the civilian United States population.

AIDS EDUCATION PROGRAM

Mr. **Sabo**. Several years ago we added a little money for an education program and we have not been able to get the services to implement it. It is not in your jurisdiction; it was under the Assistant secretary for Health, and then transfered somewhere else.

We have been getting an incredible bureaucratic run-around. What have you done in terms of AIDS research?

Mr. **Singley**. We have devoted a little over ten percent of our money in terms of the natural history and the epidemiology aspect as well as 25 percent in terms of behavioral intervention, so we are doing some work in education.

Mr. **Sabo**. Thank you.

Mr. **Wilson**. Mr. McDade.

SADARM AND MLRS

Mr. **McDade**. Thank you, Mr. Chairman.

Gentlemen, you are asking us for $105 million in R&D this year for SADARM. We have been led to believe the program was recently experiencing a slip in the testing schedule by three months. Is that accurate?

General **Pihl**. Sir, I wish it were three months.

Mr. **McDade**. Worse than that?

General PIHL. Yes. We have had a slip of 12 months for the first unit equipped for the 155 version and nine months for the first unit equipped of the Multiple Launched Rocket System MLRS—version of SADARM. This is a technology program where we have tried to upgrade the field artillery to have a smart munition.

Mr. McDADE. Is this your first fire-and-forget system?

General PIHL. Yes, where there is no laser designator involved as in the case of Copperhead. It is a counter-fire system. We know that in a counter-fire duel we want to have the SADARM capability to take out their cannon artillery, so we want to launch from both the 155 and from the MLRS.

We believe we need to do both systems because you have the surge capability that MLRS gives you and it allows you to fire SADARMs 40 kilometers deep rather than just 19, so you can find the enemy artillery at longer ranges than just the howitzer. But we need to fire it out of all of our artillery systems because we are so much out-numbered.

Mr. McDADE. That is one of the greatest areas of divergence. What is that general divergence?

General PIHL. About six to one in artillery, and it is greater than—this is normally a missile term, but it also applies to artillery. When you consider throw-weight, and I use that term carefully, they have larger caliber guns with longer ranges and can put more lead on top of you. So having said that, one of the choices, we have two contractors, two delivery systems and two size submunitions. The 6.9-inch submunition that was once designed for the eight-inch howitzer, also now fits the MLRS, and the 5.6-inch submunition, which is gun-hardened and goes inside the 155 howitzer.

One of the decisions we have made, not yet approved by the DOD because we have had a breach and we have had to report the breach in both time and cost, is to go to one size submunition and stuff it into both the howitzer and the MLRS. By putting a 5.6-inch submunition in the MLRS rather than the 6.9, we will reduce the developmental costs.

Mr. McDADE. Is that just a packaging problem?

General PIHL. Yes. But very importantly, it is not just packaging. We have made our case for SADARM as a counter-artillery device in the Army, not counter-armor. We want to eliminate their artillery in an artillery-to-artillery situation.

So you don't need the 6.9-inch submunition and the self-forging fragment that it makes to defeat an artillery piece. We can do it with the 5.6. But we want the 40 kilometer range from the MLRS. That is a fundamental change from the eight-inch MLRS theory that you are going to go after armor with a howitzer. We don't believe we can continue to do that. And that will help us control this cost growth.

Mr. McDADE. I understand what you are saying and how you are optioning back and forth, but you have a heck of a slip on both systems.

General PIHL. Yes, sir.

Mr. McDADE. Is it reflected in the budget?

General PIHL. It is not if we go to the one submunition. We don't need to bill you with the cost growth if we can download the 6.9-

inch submunition and walk away from that part of the program. In fact, we would save $7 million in the budget request.

Mr. McDade. You are saying you make that judgment, you can package it differently, limit it to taking out artillery, continue the range.

General Pihl. Go to the one size submunition, maintain the two contractors—how long we are going to be able to do that, I don't know.

Mr. McDade. Maintain the two systems.

General Pihl. Maintain the MLRS and the 155, but go to one rather than the two submunitions. We will be able to avoid the cost growth by eliminating the 6.9-inch submunition program.

Mr. McDade. When is that decision——

General Pihl. We have to see the Defense Acquisition executive sometime this month.

Mr. McDade. You will keep us appraised?

General Pihl. Yes, sir, we will.

Mr. Wilson. General, you talked about primarily use in anti-artillery, but it would be enormously useful trying to interdict truck convoys?

General Pihl. Yes, sir. Anti-material, useful for the soft-skinned vehicles, for ZSU-23/4s, for everything out there other than a T-72. But to continue to optimize the SADARM, to try to kill tanks with, which is a goal from some of those who are fans of the system, just gets you into cost trouble.

Mr. Wilson. The Air Force is working on that, aren't they?

General Pihl. They have self-forging fragment munitions also.

Mr. Wilson. But they drop them on the top of tanks?

General Pihl. That is correct.

Mr. Wilson. Mr. Miller, do you have anything else?

FLUIDTRONICS TECHNOLOGY

Mr. Miller. Just one thing, Mr. Chairman.

Last year, as I recall, or maybe two years, there was some research and development done on what was known as fluid circuit. Are you familiar with that particular research?

The program I am referring to entailed a control valve, which was known many years ago as a stop-cock, and in the core of that there were holes, and that would leave fluid out to the outside shell so that the fluid coming in and traveling to the outside shell would go through a groove and out a steel tubing port, and this would make the tank operate much smoother than the electronics that we have today.

As a matter of fact, the idea was, as I understand it, almost like an electronic circuit but instead of doing it electronically, and that is what we are doing now, we would do it hydraulically. It would do away with much of the steel tubing underneath the tank where there is a danger they could rupture; if that happens it could pull the whole system down. The tank is dead on the road.

Mr. Singley. Yes, sir. The technology referred to is fluidtronics. We had an effort in that area at the direction of the Congress. Unfortunately, the firm that we were dealing with went out of business so we had to terminate that particular contract.

However, the technology of fluidics is still being looked at within the United States Army technology base. In fact, fluidics is an effort that the Harry Diamond Laboratories has been working on for some time.

Mr. Miller. Are you saying it will be continued to be studied?

Mr. Singley. Not continued to be looked at in terms of different applications. Fluidics is impervious to electromagnetic effects, so it has enhanced survivability features. The company that we had the contract with for fluidtronics, went out of business, so it won't be continued with that particular company.

Mr. Miller. You could not continue without that company?

Mr. Singley. We cannot continue the research on fluidtronics without that particular company's proprietary technology we were directed to deal with in last year's session.

Mr. Miller. I am going to have additional questions on that and if you would answer them for the record, I would appreciate it.

[Clerk's note.—Questions submitted by Mr. Miller and the answers thereto follow:]

Question. The fiscal year 1988 Defense Appropriations bill provided $5 million to the Army for Fluidtronics research; however, one of the key participants in this program went into bankruptcy about one year ago. What is the current status of this program?

Answer. The 1989 DoD Appropriations Act, Public Law 100-463, directed that $5 million shall be made available only for development of Fluidtronics technology for use in ground combat or support vehicles. The Army responded to the requirement to assess this proprietary hydraulic control technology by purchasing hardware from Fluidcircuit Technologies, Inc. (FTI) and by initiating a contract with Idaho National Engineering Laboratory (INEL) to conduct independent laboratory testing. On January 30, 1989 the Army was informed that FTI had declared bankruptcy and was discontinuing business. FTI said that its business misfortune had no relationship to its dealings with the Army. On May 18, 1989 the Assistant Secretary of the Army for Research, Development and Acquisition informed the Congress that FTI would no longer be able to technically support the Army's program, and, under those circumstances, legislative relief was requested to allow reprogramming of the remaining funds. The Army continued the contracted evaluation of the hardware supplied by FTI and INEL reported that the Fluidtronics hardware failed endurance testing due to system leakages. The Senate and House Appropriations Committee's fiscal year 1990 report language provided relief to the Army to reprogram the remaining funds. The funds were reprogrammed and the Fluidtronics program has been discontinued.

Question. Will the Army continue to pursue research in this technology?

Answer. The Army does not plan to pursue research in Fluidtronics.

Question. What potential applications does Fluidtronics have for Army systems?

Answer. Industry may propose any technology, including Fluidtronics, that it believes best meets the Army's performance oriented requirements for product improvements to current systems and for new systems. Through this competitive process, the Army will be able to acquire the best capabilities that are affordable. The Fluidtronics technology concept could present an alternative technical approach to other vehicle hydraulic technologies.

M1 TANK PRODUCTION

Question. Several foreign nations have expressed interest in the M1 tank. What are the potential foreign military sales for the M1?

Answer. The United States now has a co-production agreement with Egypt to produce 555 M1A1 tanks. The first 15 tanks will be completely assembled in the United States and shipped to Egypt in the 4th Quarter, FY 1991. The U.S. will then begin shipping about 10 "kits" a month to be assembled in Egypt. That program will be completed in 1996. The U.S. is also actively negotiating with Saudi Arabia for the sale of 315 M1A2 tanks. Deliveries could begin in the 2nd Quarter, FY 1993 following the termination of U.S. procurement.

Other countries which have expressed an interest in the Abrams M1A2 tank are the United Kingdom, Pakistan, Sweden, Canada, Kuwait, and the United Arab Emirates.

Question. Recognizing that unit price will depend on what agreements are reached with foreign nations and the number of tanks to be produced, can you assess, at this time, what impact the decision to terminate production of the M1 will have on unit costs?

Answer. Without a supporting U.S. procurement base, the unit costs for potential Foreign Military Sales will probably increase to the point where the tank will not be competitive in the world market. To best demonstrate the impact of U.S. procurement termination, preliminary studies show that for the U.S. to achieve a saleable (<$4.0 million weapons system cost; escalated dollars) M1A1 or M1A2 tank, DOD must procure at least 25 M1A1s or 38 M1A2s per month. Foreign Military Sales (FMS) add ons will drive those required numbers down.

Question. It is my understanding that the Army will mothball production lines at the current manufacturers until production begins on the Block III version and as a hedge against possible contingencies. What annual costs will be incurred to preserve this manufacturing capability and what will it cost to restart production?

Answer. Estimated annual maintenance costs to preserve the manufacturing capability at Detroit Arsenal Tank Plant and Lima Army Tank Plant are $.8 million and $1.8 million respectively.

An Army team headed by the Tank-Automotive Command with participation from the Program Executive Officer for Armored Systems Modernization, and the Abrams Project Manager is now working with Armaments, Munitions and Chemical Command, General Dynamics Land Systems, and other major suppliers of the tank on a study which will analyze strategies, cost estimates and time-phased plans for closure of Abrams tank production to include the critical vendors. Among other requirements, the team was tasked to establish a strategy, cost estimate and time-phased plan for the tank production facilities assuming a restart from a cold production base (both Block III and Abrams M1A2 scenarios). The results of their study, to include accurate cost figures on restarting production, are not expected until late Summer, 1990.

However, preliminary analysis does show that the cost to start up Block III will be significantly higher without a warm production base; but that the cost of a trickle M1A2 tank production and expected FMS is greater than layaway and startup.

[CLERK'S NOTE.—End of questions submitted by Mr. Miller.]

Mr. WILSON. Thank you very much for your testimony. We have other questions for the record. We are looking forward to getting to know you better, Mr. Conver, and we are going to miss you, General Pihl.

General PIHL. Thank you, sir.

Mr. WILSON. We stand in recess until 2:00 o'clock.

[CLERK'S NOTE.—Questions submitted by Mr. Wilson and the answers thereto follow:]

ANTITANK WEAPON SYSTEM

Question. In the fiscal year 1990 Defense Authorization Act, the Congress directed the Army to conduct a side-by-side test and evaluation of the Bofors Bill, Milan, and Dragon II antitank weapon systems. Funding for the test was to be taken from previously appropriated funds in fiscal year 1988 and fiscal year 1989. The Army has testified that some of these funds are unavailable, but no effort has appeared to have been made to identify sources of funds which the Congress would approve.

We know of the Army's reluctance to proceed with the tests, but there is a Congressional mandate to be met. Is the Army prepared to come forward with a request, and will the Army be deliberate in identifying a source of funds which the Congress can agree to?

Answer. Congress specified, in law, the fund sources the Army was to use for these tests—fiscal year 1988 MILAN and BILL test funds, Dragon III funds from the terminated DRAGON III contract and other fiscal year 1988/89 funds available to the Secretary of the Army. The first two funding sources were not available so the Army submitted a reprogramming request to OSD on 17 January 1990 requesting approval to use fiscal year 1990 dollars to fund the SIMATS tests. OSD disapproved the Army request for reprogramming on 8 February citing the fiscal year 1989 National Defense Authorization Act directive that fiscal year 1988 or fiscal year 1989 dollars be used to fund the SIMATS tests.

The Army opted to request reprogramming authority to use fiscal year 1990 funds instead of fiscal year 1989 funds because of the length of the tests and the fact that fiscal year 1989 RDTE funds expire in September of this year. The problem here is not the availability of a bill-payer to reprogram funds from, but is in the law's requirement to use fiscal year 1989 funds. We simply cannot execute a test of this magnitude with funds that expire in September of 1990. In fact, if fiscal year 1989 funds had been available the day the fiscal year 1990 National Defense Act was signed, we could not have procured two foreign weapon systems and completed these tests before the funds expired.

Question. It is my understanding more than sufficient funds are available in the NATO and non-NATO cooperative testing program. In the four months since enactment of this legislation, has the Army attempted to secure those funds for this purpose? If not, why not, since this is surely a source over which the Congress should have no objection, since the program was created for just this kind of comparative and cooperative analysis?

Answer. No, we have not. The funding sources for these tests were specified in law. The first two sources were not available. The third source of funding specified was "other fiscal year 1988 or fiscal year 1989 funds available to the Secretary of the Army". Our best estimate is that these tests will take 17 to 20 months to complete. A test of this magnitude cannot be executed with funds that expire in September of 1990. The Army will require relief from the statutory requirement to use fiscal year 1989 funds for these tests. Subsequent to that, Congress will have to either appropriate funds for these tests or will have to approve a reprogramming action.

Question. Why does the Army want to kill this test when it would provide empirical data on the available off-the-shelf medium range antiarmor technology? Cannot this information be valuable to the Army and to the Congress as it assesses the future potential of the threat in this area and our response to it?

Answer. The Army has already extensively tested all these systems. Which of them is the best is not an issue when considering the "future potential of the threat". The fact is, none of these three candidates, DRAGON II, BOFORS BILL, nor MILAN, are effective against the future threat. In fact, none of them are effective against the current threat protected with reactive armor.

Question. To my mind, providing the troops with the very best in available technology should be of utmost concern. Previous testing between Bofors BILL and Milan demonstrated the superiority of those systems over the Army's existing inventory, according to the director of operational testing and evaluation. Since the Army chose not to act on the analysis of those tests and retained the Dragon system, I believe it is imperative that the Army conclusively demonstrate the comparative capabilities of these systems before any further action is taken. Many in Congress feel strongly that the Army must respond to this mandate. When will the Army present to the Congress a reaonable request for funding?

Answer. The funding sources for these tests were specified in law. The first two sources were not available. The third source of funding specified was "other fiscal year 1988 or fiscal year 1989 funds available to the Secretary of the Army". Our best estimate is that these tests will take 17 to 20 months to complete. A test of this magnitude cannot be executed with funds that expire in September of 1990. The Army will require relief from the statutory requirement to use fiscal year 1989 funds for these tests. Subsequent to that, Congress will have to either appropriate funds for these tests or will have to approve a reprogramming action.

[CLERK'S NOTE.—End of questions submitted by Mr. Wilson. Questions submitted by Mr. McDade and the answers thereto follow:]

120MM MORTAR AMMUNITION

Question. Last year, as part of the Bush defense budget revisions, the Army received $6.9 million for the purpose of completing development and operational testing of the enhanced family of ammunition for the 120mm mortar. The Committee was advised this funding was adequate to complete this effort.

Give us a status report on the 120mm mortar enhanced ammunition development program (current development and testing status, and schedule for completion of development, testing and type classification).

Answer. We are pleased to report that we achieved our March 22, 1990 objective for type classifying the NDI 120mm system which provides us with the technical data package and the technology springboard for further progress for the onshore production of the carrier system with its enhanced ("Americanized") family of ammunition.

Our enhanced ammunition development plan reflects the following major milestones (dates approximate):

Completion of development: April 1990;

Developmental testing: May–September 1990;

System full operational test and evaluation (with the carrier weapon): January–March 1991;

In-process review activities: October 1990–July 1991;

Type classification—limited rate production: March 1991;

Award and production: January 1992 and beyond;

First Article Initial Production Test: January–May 1993;

Type classification—standard: June 1993;

First unit equipped: April 1994.

Question. Are additional development funds required to complete this work?

Answer. While the fiscal years 1990 and 1991 budgets are adequate to complete all planned 120mm system development, there is an unprogrammed requirement of $500,000 to upgrade the M64A1 sight unit to ensure its compatibility with the 120mm weapon. This deficiency was revealed by operational testing.

Question. The Army reportedly has been examining a number of new applications of the 120mm mortar family. These include an "under-armor" variant of the 120mm system, and also "cargo" mortar rounds carrying submunitions, and even guided mortar rounds using either electro-optic guidance or terminal guidance systems. Please give us a rundown of the Army's current plans in these areas. Is funding programmed to support future developments in these areas?

Answer. The Product Manager for Mortar Systems is investigating several generic and item specific RDT&E projects. These programs have been structured as an incremental approach to development. Several mortar equipment improvements are planned as the first stage concurrent with evaluation of existing and emerging technologies. All are currently unfunded although requirements have been identified and will be submitted for consideration during the Long Range Research, Development, and Acquisition Plan (LRRDAP) review process.

The following projects are currently proposed for start-up in FY 1991-93 as 6.7-funded RDT&E efforts with first year estimates as indicated:

1. Upgraded sight and enhanced fire control system applicable to the 60, 81, and 120mm systems; $2.0 million.

2. Soft recoil mechanism and improved baseplate for the 81mm mortar system which will have applicability to the 60 and 120mm weapons; $1.0 million.

3. Improved blast overpressure devices that have application to the 60, 81, and 120mm programs; $0.6 million.

4. Composite bipods for the 60 and 81mm mortars; $1.0 million.

Due to the financial decision not to produce a 120mm mortar training round, a requirement has been identified for an 81mm M29 training insert for the 120mm mortar weapon. This effort will permit realistic crew training utilizing training ammunition such as the 81mm M880 short-range practice cartridge. The total requirement is $0.5 million RDT&E and a single year's production cost of $1.25 million, both of which are unfunded.

The following programs, which will utilize enhancements cited in the 6.7 programs above, are still in the planning stage. These have potential application to the 81mm and 120mm mortar systems, are unfunded, and have RDT&E proof-of-principle start costs and approximate times as indicated:

1. A generic bi- or multi-spectral smoke cartridge that will provide smoke/obscurant cover during offensive and defensive operations and will utilize the existing configuration 81mm smoke cartridge body and fuze.

2. A dual-purpose improved conventional munition (DPICM) cartridge which will utilize the existing configuration of the 81mm illumination cartridge body and fuze and be loaded with DPICM submunitions.

3. An enhanced lethality mortar cartridge with antipersonnel and antimateriel capability which can be fired from existing weapons; FY 1996—$2.4 million.

4. An enhanced automated mortar system which will provide a highly survivable mortar with increased range and improved accuracy. The under-armor system will have enhanced fire control and an autoloading robotic system; FY 1998—$6.0 million.

5. An 81mm autonomous, terminally-guided mortar cartridge with technology adaptable to 120mm mortars; FY 1997—$12.1 million.

60MM MORTAR AMMUNITION

Question: In the FY 1990 Appropriations Act, at the request of the Army $1 million was added for the purpose of completing development of the 60mm mortar short-range training round (XM840).

What is the status of this effort? When is type classification expected? Are additional development funds required for FY 1991?

Answer. The FY 1990 Appropriation Act development funds were appropriated but not authorized. We have, however, initiated the requisite correspondence to the Congress to request the authorization of those funds.

Based upon our expected availability of funds, we contacted the proposed sole-source contractor to initiate negotiations for licensing rights; we also conducted a market survey. Both these undertakings were prerequisites for the noncompetitive award of a production contract for a 60mm short-range practice cartridge to meet the Army's training requirements.

The contractor declined to discuss licensing rights and the market survey revealed the existence of other potential sources. We are therefore notifying the Congress, as requested in the FY 1990 Appropriations Act, that a noncompetitive strategy is no longer a justifiable option.

Given these circumstances, we are proceeding with a competitive strategy supported by limited testing. Our plan is to type classify—"generic" the performance specification by 4QFY90, conduct competitive testing by 2QFY91, buy a number of rounds sufficient to allow us to type classify—"standard" in 4QFY91, and equip our first unit by 2QFY93. Implementation of this plan will require an additional $1.6 million developmental funding in fiscal year 1991.

ARTILLERY DELIVERED EXPENDABLE JAMMER (AD/EXJAM)

Question. According to your testimony last year, the FY 1991 budget will contain funding to complete development of the XM-867 artillery delivered expendable jammer (AD/EXJAM). With this funding, and successful completion of the development program, you indicated procurement funding for the AD/EXJAM would begin in the FY 1992 budget. Have there been any changes in the develoment and procurement schedule and funding profiles you provided the committee last year? If so, please explain why.

Answer. Yes, there have been changes in the schedule. Problems experienced by the contractor during test in late FY 1989 forced a redesign of the power output board of the jammer which caused a 10 month slip in the Critical Design Review (CDR), and subsequent development and testing. This redesign underwent a very extensive design test in January 1990 and recently passed the CDR in March. Production start has been delayed until FY 1994.

Question. How much money is requested in the FY 1991 budget for development on the XM-867? (Please indicate both amount and program element.) Provide a brief description of the planned use of these funds.

Answer. There was ——— requested in FY 1991 for AD/EXJAM in program element 0604270A. These funds are required for completion of AD/EXJAM rounds needed to support technical and operational tests as required by the AD/EXJAM Test and Evaluation Master Plan (TEMP).

Question. Does the Army still intend to begin procurement in FY 1992? Please provide programmed quantities and funding levels by fiscal year.

Answer. No, procurement will not begin until FY 1994 with a production of ———.

Question. What is the procurement acquisition strategy for the XM-867?

Answer. The Army plans to start full scale production with a competitively selected contractor in FY 1994. The Army is also investigating the possibility of a joint production program with other countries. Australia, Germany, Denmark, and Israel have all expressed interest in a joint AD/EXJAM program.

Question. The XM-867 is designed to be carried by 155mm artillery shells. Which type of 155mm shell will be utilized, and why?

Answer. The standard Army artillery cargo round, M483A1, will be utilized. This shell was selected in order to promote standardization, reduce development and production costs, and minimize logistical support requirements.

Question. This device appears to have the potential for use in other indirect fire weapons. Could an AD/EXJAM type device be utilized with MLRS, or even heavy mortars? Is the Army considering application of this technology to other "carriers" such as these?

Answer. Both MLRS and heavy mortars have been investigated as potential "carriers" for the AD/EXJAM with less than optimum results for both. Use of the MLRS would require major, and costly, redesign of the power supply. MLRS does not exert enough "g" force on the AD/EXJAM battery to activate it. More importantly, the MLRS dispersion pattern and packaging system is not optimal for the AD/EXJAM mission ———. Use of the heavy mortar would require major, and even more costly, redesign of the entire electronics package. The diameter of the mortar is too large for the existing package. In addition, ———.

Question. Briefly describe the planned employment doctrine for the AD/EXJAM.

Answer. The AD/EXJAM rounds will be stocked as a basic load on the ammo train. They will be drawn from the stockpile by Division, Separate Brigade and Armored Calvary Regiment Artillery units as required. The rounds are fired to predetermined target areas. While in flight over the target area, ———. AD/EXJAM will give unit commanders the capability to conduct command, control, and communications countermeasures across the FLOT without interfering with friendly communications and without requiring extensive signal database support.

ARMOR/ANTI-ARMOR PROGRAM

Question. There have been reports in the media that DARPA is planning to transfer most, if not all, of its special Armor/Anti-Armor work to the Army. As you know, this program was a SECDEF-directed effort beginning about five years ago whereby DARPA would investigate potentially revolutionary techniques for both armor protection as well as anti-armor weapons. The committee has been a strong supporter of this program. Are these reports true? If so, please describe what efforts will be transferred to the Army, the planned timetable, the Army organization which will receive this new effort, and the funding which you have programmed for this.

Answer. The Army/DARPA-USMC A^3 program will transition to Army funding lead in FY1991. The terms of the existing MOU will be successfully completed and the program will be continued. Although the original five/year MOU for this program expires this year, the Army is working with DARPA, the USMC and the Department of Energy (DoE) to achieve an efficient transition of this program from DARPA to Army lead. During a meeting with Army officials on March 23, 1990, Dr. Fields, Director of DARPA, announced his willingness to continue the Joint Project Office (JPO) at DARPA even though the Army will furnish the major portion of the funding. We view this change on the part of DARPA as a positive step toward achieving our goals of retaining the basic nature of the joint program and of continuing to support the industry created by this effort. By tapping the innovation of industry, we have created a healthy competition between industry and Government labs in this vital area. We must preserve this. The Army has included in its outyear plans increased funding for the continuation of the critical program. Total funding from all sources for FY1991 continuation of this program is approximately one-half ($44 million) of FY1990 funding ($88.6 million). Our FY1991 budget request includes $11 million for transition of this joint program. DARPA FY1991 funding is approximately one-third ($11 million) of what it was in FY1990 ($36.4 million). Programmed funds will permit continuation of some of the highest priority aspects of kinetic energy penetrators, armor, Red Design Bureau and the Vehicle Survivability Program. Available funding levels will cause us to substantially reduce funds for chemical energy warheads, materials technology, modeling, soft kill, and the Advanced Technology Assessment Center. In the restructuring of its overall business plan, DARPA has announced its intention to fund only high risk, high payoff technologies based on specific proposals rather than broad MOUs. The Army fully expects to successfully transition the program, continuing the highest payoff efforts from the current program that are affordable within anticipated funding levels.

[In millions of dollars]

	Fiscal years—				
	1986/1987	1988	1989	1990	1991
DARPA	58.4	41.3	49.1	36.4	11.0
Army	20.6	17.0	21.5	23.7	11.0
USMC	4.3	2.4	5.2	5.0	5.0
BTI	13.0	8.5	12.4	10.0	7.0
Nunn	0	0	3.6	13.5	10.0
Total	96.3	69.2	91.8	88.6	44.0

Question. DARPA was particularly enthused about results it had been achieving in developing new heavy alloys (especially tungsten-based materials) which held great promise if used as penetrating material for anti-armor kinetic rounds. The Army advised us it was closely monitoring these efforts. Is the Army going to assume control of these efforts? If so, please provide the planned timetable, the Army organizations which will receive this new effort, and the funding which you have programmed for this.

Answer. There is a sub-scale Tungsten Penetrator Program underway at DARPA that is scheduled to be completed by the end of FY1990. Based on the performance results of this program, a decision will be made on the readiness to initiate a full-scale penetrator demonstration program. DARPA has identified a full-scale follow on program at an estimated cost of $8.5 million over three years, but has not resourced that effort. In the course of transitioning the program from DARPA to Army lead, we will determine which programs we can afford to continue based on funds available, Army requirements and potential of competing programs to meet our needs.

Question. Please identify those contractors who are participating in this effort.

Answer. Battelle Memorial Institute is the prime contractor.

Question. Describe how this work will either complement or compete with the Army's own development efforts for kinetic penetrators.

Answer. The Army is enthusiastic about this effort, which complements our search for alternate kinetic energy penetrator material. Thus far, the mechanical properties predict performance superior to previously tested tungsten penetrators. The preliminary ballistic test results show performance matching predictions.

Question. Doesn't the DARPA work in this area warrant the inclusion of its advanced penetrators in the Army's ongoing Armament Enhancement Initiative (AEI) to upgrade the lethality of Army tank ammunition?

Answer. All DARPA work in this area is monitored closely by the Army and selected penetrators will be candidates for AEI.

[CLERK'S NOTE.—End of questions submitted by Mr. McDade. Questions submitted by Mr. Young and the answers thereto follow:]

ARMY TECHNOLOGY BASE MASTER PLAN

Question. Gentlemen, this country's superior war fighting ability has provided deterrence to democracies here and elsewhere which in turn has been the major building block of the tremendous growth in democracy and freedom in the Communist world. That war fighting capability is founded on the greatest Research and Development base available in the world. The irony is that now we are faced with an effort by some to dismantle a great part of the war fighting capability the realities of which we cannot ignore.

What really concerns me is what could happen to the private research and development base as we cut back on production of these weapon systems. Investors are becoming uneasy about the return on investment in the defense industry—they can make more elsewhere. Corporate raiders out to make a fast buck are common place in today's economy and much of our Defense Industry is vulnerable to their greed because many of these companies are worth more split up than they are as a team.

I want to compliment the Army for what appears to me to be a recognition of this problem in the creation of the Army Technology Base Master Plan. In fact Mr. Singley devotes a large portion of his prepared statement to this problem. But he also makes reference to "a decline in U.S. defense industry long-term R&D investment". And that's what I want to talk to you about.

A lot of our country's R&D effort is visible—through your budget which I'm happy to see is even a little bigger this year than last. But a lot of the R&D effort is not visible. The private sector plows a lot of its own profits into R&D hoping to recoup it in future production. But if that future production is not there, it could just as easily pay itself more in profits. If someone not concerned about the future were to acquire a defense company, he might just pay himself instead of invest. If a foreigner, not concerned with our country's military capability, were to acquire a defense company, he could just reap profits instead of invest in R&D.

How can we keep those things from happening? What portion of real R&D is visible and what is not? How does IR&D enter into this picture?

Answer. The Department of the Army and the Department of Defense as a whole share your concerns about the erosion of the U.S. defense industrial base and the potential loss of our world leadership in a number of critical high technology areas. Research and development performed and sponsored by the DoD and the Defense industry have traditionally been a major contributor to America's leadership role in many technology areas. A declining defense budget (especially procurement appropriations) threatens the sustained corporate sponsorship of defense related research and development. If a ready market and reasonable return on investment are not perceived, industry will not invest its scarce R&D dollars in this area.

With regard to the visibility of research and development, most corporate R&D is closely held as proprietary information by the company. It is often the company's main competitive edge and is not shared with the Government or anyone else. The first evidence of the fruits of this R&D may be the publication of papers in scientific journals, presentations at technical meetings, the filing of patents, or the appearance of new or improved products.

In the case of Independent Research and Development (IR&D), this R&D is visible to the Department of Defense. It is reviewed and graded by knowledgeable, DoD laboratory personnel, and is taken into account in the planning of the Services' R&D programs. Participation in this program is mandated for Defense contractors who exceed a certain dollar threshold of business with the DoD and the amount of IR&D performed varies from year to year with the amount of business the company conducts with the DoD. The cost of the IR&D is recovered by the company as a percentage of the overhead charged to Government contracts. As a result, if DoD procurement budgets are reduced the amount of IR&D performed will also be reduced.

Two possible avenues to promote increased defense related R&D would be to increase the Services' R&D budgets even as procurement budgets are shrinking, or to allow companies to recover an increased amount of IR&D funds from those contractual efforts that will remain.

THE NEW TANK

Question. Let's take for example the new tank. We build the best tank in the World. It could be better—it could be lighter, the track could last longer, it could have a shorter logistics tail, and those are some of the things you are going to address with the next tank. But for the near term we are going to stop producing them for several years. Now if I were an investor in a company that was involved in the future tank and I was only worried about my money, and I saw what was happening in Europe, I might think about investing my money elsewhere. But we could be in a position to need that tank so how are we going to ensure that the private sector continues to contribute its own money to tank development?

Answer. In order to retain the established partnership between Army and Industry in Combat Vehicle Systems, we will have to do a better job of controlling the on-again-off-again signals industry has been receiving basically caused by program instability affected by budgetary shifts. Industrial investment in the tank program and related technology development will continue as long as we can retain program confidence and forward momentum in Armored Systems Modernization (ASM) planned initiatives.

For the past four years the Army has been developing its modernization needs for the Close Combat Force. The effort culminated into the ASM Strategy (formerly called the Heavy Force Modernization). This strategy focuses on the development of an initial package of six critical systems chosen based on projected war fighting requirements. The six systems consist of the Block III Tank, Combat Mobility Vehicle (CMV), Advanced Field Artillery System (AFAS), the Future Infantry Fighting Vehicle (FIFV), the Line-of-Sight Anti-Tank Vehicle (LOSAT), and the Future Armored Resupply Vehicle—Ammunition (FARV-A). The strategy employs the use of Advanced Technology Transition Demonstrators (ATTDs) to exploit ongoing technology, mature candidate components and shorten development timelines for Advanced Development.

Up until now, industry has played a key role in the development of conceptual options for the ASM systems. We estimate that in the past three years, the three industrial teams (GM, TCM, AVTA (made up of GDLS/FMC)), with up to 100 sub-contractors, have invested approximately $30 million of their own money to help define the ASM options.

In July, the Army plans to award two Common Chassis ATTD contracts to design, fabricate, and demonstrate a common chassis prototype system to carry the Block III Tank, CMV, AFAS and FIFV systems.

First application of the common chassis will be for the Block III tank system. Over the life of the common chassis ATTD effort, FY90-95, the two contractual teams will spend up to $460 million in the development of chassis options for the future tank. We anticipate that the winning teams will also invest heavily their own assets to make sure that they are in a favorable position to bid on the follow-on effort: The full scale development of the Block III tank.

HELICOPTER PROGRAMS

Question. In the case of the LHX in the Army and the ATF in the Air Force, a number of companies are investing huge amounts of their own money in R&D. In 'the case of the LHX, some have even invested lots of their own money and are already out of the game. What can we do to make sure the industrial R&D base does not disappear when we down select? Are we asking the private sector to take on too much on their own?

Answer. The Light Helicopter (LH) Full Scale Development Program will provide the R&D industrial base with $2.9 billion (escalated $) through 1997. Other Department of Defense R&D programs also continue to contribute funds to the R&D industrial base. This base will not disappear.

The LH program has not asked industry to cost share the development of the LH air vehicle and mission equipment. The Army feels it has fully funded the Demonstration/Validation phase of the program and has projected sufficient funds to fully fund the full development phase.

INDUSTRIAL BASE

Question. As investment capital becomes scarce here in this country, the Japanese are quick to jump in and acquire assets here. They appear to be attempting to become the world's banker. What are we doing to make sure in the Defense Industry that foreign interests who might not have our long term Defense interest at heart are not taking over these companies?

Answer. The Army participates in the Committee on Foreign Investment in the U.S. (CFIUS) review process. CFIUS, which is chaired by the Treasury Department, reviews proposed foreign acquisitions of U.S. companies for possible national security implications. If, after this review, the Committee considers the acquisition to be detrimental to the national security, a recommendation is forwarded for Presidential action.

[CLERK'S NOTE.—End of questions submitted by Mr. Young. Questions submitted for the record and the answers thereto follow:]

STRATEGY UNDERLYING WEAPONS DEVELOPMENT

Question. For the past few years, the development of Army weapon systems has been predicated on the concept of deep attack of Soviet forces, formally called "Follow-on Forces Attack". Recent events in Europe call this strategy into question. Please explain the original "Follow-on Forces Attack (FOFA)" strategy and the "AirLand Battle" concept.

Answer. The FOFA strategy evolved in response to Soviet conventional theater offensive strategies that require large groupings of second echelon forces ("follow-on forces") to reinforce and exploit success in the Main Battle Area (MBA). The objective of FOFA is to attack these deep forces to control their arrival at the Main Battle Area. Attack of these forces by focused, deep operations exploits enduring western technology advantages, such as long range target acquisition and precisions guided munitions, and allows numerically smaller, defending NATO forces to meter the arrival rate of enemy forces at the MBA, thus providing opportunities to gain the initiative.

AirLand Battle is the Army/Air Force over arching doctrine for fighting a land war. It includes deep operations, closely synchronized with the Main Battle Area fight and is appropriate for Joint combat in any region of the world. It is not exclusive to the NATO central region and provides guidance on the conduct of close, rear, and deep operations (including follow-on forces). FOFA is an important component of AirLand Battle.

Question. How do changes in Europe affect this strategy?

Answer. Changes in Europe will result in fewer NATO and Warsaw Pact forces facing each other. Remaining U.S. and NATO forces will have far greater areas to defend. Capabilities essential to find and engage echeloned attacking forces and reserves will become more important for the defense, given that smaller forces are much less tolerant of surprise. As a smaller force proportionately defends a larger area, the application of FOFA related systems will be equally important in fighting and conducting the ensuing operations at great ranges on the flanks in support of adjoining corps, as well as in the enemy's depth.

Question. What efforts are ongoing to redefine and update the Army's strategy?

Answer. The Army's AirLand Battle doctrine is being reviewed in light of the changing threat and situations world-wide by our Training and Doctrine Command (TRADOC). This review will eventually result in an AirLand Battle-Future doctrine that addresses the changing situation in Europe and in other regions of the world where US forces might be employed.

Question. How do these actions affect the requirements for and development of Army weapons systems?

Answer. Both the changing situation in Europe and other regions of the world, and the AirLand Battle-Future initiatives will affect Army requirements. To date, the fiscal and political trends which dictate a smaller force structure, concurrently dictate greater demands for long range intelligence and target acquisition systems, improved deep operations capabilities, and modern command, control and communications systems. This is dictated by a more deployable, smaller force having to fight over larger areas.

LIGHT TANK

Question. After the events in Panama, the Army has more clearly realized its need for a lighter tank which could be used in "hot spots" around the globe. The Army's plan would be for a tank approximately one-third the weight of the M1A1, which could be deployed quickly and could be operated in areas unsuited for the heavy M1.

What are your plans concerning this light tank and what are the parameters of the program (i.e. weight, gun size, etc.)?

Answer. The Armored Gun System (AGS) will replace the currently fielded M551A1 Sheridan in the XVIII Airborne Corps. The AGS will be used primarily in contingency force operations and must be designed for Low Velocity Air Drop (LVAD). This requirement will limit the vehicles weight to approximately 35,750 pounds, which will allow for sufficient fuel and ammunition in order that the vehicle be combat capable immediately after de-rigging. Additionally, the LVAD requirement limits the vehicle dimensions to 92.5 inches in height and 107 inches in width. In order for the AGS to drive-on/drive-off from a C130, the width at the ground is further limited to 100 inches. ———.

Question. What has the Army done as far as talking with industry about this concept of a light tank?

Answer. Several industry contractors have expressed interest in the Army's need for a new Armored Gun System. The Army's

Tank Automotive Command (TACOM) has released a marketing questionnaire to both U.S. and foreign companies requesting information on available systems that may meet the Armored Gun System (AGS) requirements. This market survey is similiar to the one conducted in 1987 before the Army had to withdraw from this effort during the 1989 amended budget submitted to OSD. The Marine Corps reviewed and provided comments to the Army during the development of this revised market survey questionnaire.

Question. Your concern about using wheeled vehicles for tank operations has focused on the need of the tank to absorb recoil. Since the recoil on the small tank may well be less, will you consider a wheeled vehicle for your light tank?

Answer. Yes. The Army has made no final decision on whether the AGS will be a tracked or wheeled vehicle system and will consider all potential candidates.

Question. Why not simply use the Marine Corps' Light Assault Vehicle-Assault Gun (LAV-AG)?

Answer. The Marine Corps' Light Assault Vehicle-Assault Gun (LAV-AG) program is designed to meet their unique deployability requirements for having an assault gun capable of amphibious assault operations (swim) and being airlifted by their primary heavy lift helicopter (CH-53E). The Army's Armored Gun System (AGS) must be capable of being rapidly deployed for contingency operations world-wide, while being compatible to the unique operational requirements of the XVIII Airborne Corps. To meet the operational and deployability requirements, the AGS must be designed for Low Velocity Air Drop (LVAD). The LVAD requirement sets a weight limit of 35,750 pounds and system dimensions of 92.5 inches high. The Marine's LAV-AG has a weight limit of approximately 29,000 pounds in order to be airlifted by their CH-53E. To meet AGS armor protection levels, the LAV-AG would require added armor which will exceed the 29,000 pound lift limit required by the Marine Corps. Furthermore, the additional armor needed to meet the AGS protection requirements would increase the LAV-AG weight beyond its system capabilities of 32,000 pounds. The LAV-AG system has a basic chassis height of 73 inches and a 105mm turret, would add a minimum of 27 inches for a total height of 100 inches. This height exceeds the maximum height requirement (92.5 inches) to conduct LVAD operations.

BLOCK II TANK (M1A2)

Question: After an R&D investment of approximately $300 million, the Army has recently changed its plans for production of the Block II Tank (M1A2) program. The Army has decided to purchase only 62 M1A2 tanks rather than the original plan of 2,926 tanks. This decision was based on the political changes in Europe, force reductions, and the prospect of future reduced defense budgets.

Isn't it true that the current program essentially supports Foreign Military Sales, not the U.S. Army. Is this wise?

Answer. The primary reason to continue the development program for the Block II tank is not to create an attractive weapons system for Foreign Military Sales, but to preserve the available technology options for the United States if tank production becomes necessary in the midterm.

The Army would prefer to field the finest tank in the world to its own forces. However, given the need to balance its forces in view of changing global contingencies, and the budgetary restraints it is now facing, the Army is prepared to accept some near term risk with the capabilities of the tank it now has in its forces. The trade-off is one which accepts risk in the near and mid term by not matching or over-matching the FST 2 with the production of the M1A2 in order to develop and field an over match to the FST III in the far term.

With the decision to truncate M1A2 production, Foreign Military Sales is the only option to keep the U.S. tank production base warm in the event the Army must resume U.S. procurement in the midterm. Keeping the M1A2 in production longer will support the technology transition to the Block III tank, and also supports the strategy of keeping modernization efforts on schedule by focusing on the future rather than the midterm. It allows the U.S. to continue the development and eventual fielding of the Block II tank, the tank system for the future Army.

ARMORED SYSTEMS MODERNIZATION (ASM)

Question. The Army's Heavy Force Modernization program was established to build a family of new ground combat vehicles (New tank, new Bradley, etc.) on a "common chassis". The fiscal year 1991 budget request includes R&D of $347.6 million for this initiative, an increase of 37 percent from last year's appropriation. Furthermore, the Army has changed the focus of this program and renamed it "Armored Systems Modernization".

What is the strategy behind the Army's "Armored Systems Modernization" program and how does it differ from the "Heavy Force Modernization" program and the "Armored Family of Vehicles" which proceeded it?

Answer. The Army's strategy to modernize its ground combat systems has changed to reflect a new world situation. The philosophy behind our strategy is to field a more capable, timely, and affordable force by exploiting the operational and economic benefits afforded by maximizing commonality in system chassis design and components and by employing an expeditious approach to modernization utilizing Advanced Technology Transition Demonstrations (ATTD), NDI procurement, and fielding to First-To-Fight units.

The ASM Program encompasses the Block III Tank, Future Infantry Fighting Vehicle (FIFV), Advanced Field Artillery System (AFAS), and Combat Mobility Vehicle (CMB) on a new development heavy chassis; the Line-of-Sight Anti-Tank (LOSAT) and the Future Armored Resupply Vehicle-Ammunition (FARV-A) on the Bradley Fighting Vehicle System (BFVS) family of chassis; and the Armored Gun System (AGS) as a Non-Developmental Item (NDI) procurement.

ASM differs from the Heavy Force Modernization (HFM) Program in that it is a more comprehensive plan that reflects the Army focus on modernizing of its total armored forces: light, medium, and heavy. With this expanded focus the Army has added the high priority Armored Gun System to replace the 30 year old M551 Sheridan in our contingency forces.

The Armored Family of Vehicles (AFV) study recommended fielding one to one plus divisions annually with up to thirty new systems. This revolutionary, unconstrained approach was unrealistic and unaffordable. As a result the AFV concept was not pursued. Subsequently, the Army carefully prioritized its requirements for modernizing its armored forces based on the future battlefield, our evolving doctrine, threat projections, system warfighting contributions, maturity of system associated technology, and affordability. The primary feature recommended by the AFV Task Force retained in ASM is the concept of maximizing commonality in chassis design and components without trading off required operational capabilities.

Question. How stable are the requirements for a program which has experienced 3 name changes in 3 years?

Answer. The requirements are very stable. When the Armored Family of Vehicles (AFV) Task Force was discontinued the Army prioritized its requirements for fielding new systems. The resulting requirement to field six priority systems, Block III Tank, Advanced Field Artillery System (AFAS), Combat Mobility Vehicle (CMV), Future Infantry Fighting Vehicle (FIFV), Line-of-Sight Anti-Tank (LOSAT), and Future Armored Resupply Vehicle-Ammunition (FARV-A) has not changed. The addition of the Armored Gun System (AGS) to replace the M551A1 Sheridan in our Contingency Forces reflects the broadening of the concept to encompass all armored systems, light, medium, and heavy. The approved requirement for the AGS has existed since 1986.

Question. Why did you change the focus of this initiative to include a "light system"—the Armored Gun System?

Answer. The Armored Gun System (AGS) has been added to ASM based on the need for a rapidly deployable system for contingency forces. The Soviet Union will remain our most capable competitor in the foreseeable future, but the Army must also field capabilities that can defeat other threats around the world, as evidenced in Panama. The AGS, to be procured through a non-developmental item (NDI) acquisition, will solve the near term problem for the contingency forces. To maintain consistency and integrity in the modernization of all our armored systems; light, medium, and heavy, and to ensure the advantages of integrated development and commonality are fully explored, AGS has been added to the Armored Systems Modernization umbrella.

Question. Are there any funds requested in the budget for the Armored Gun System?

Answer. No. The first year of proposed funding will be in fiscal year 1992.

Question. Will the AGS share a common chassis with the tank or with the LOSAT (Bradley chassis)?

Answer. The Army has made no decision as to what type of chassis the AGS will have.

Question. What are the future procurement plans for the AGS?

Answer. Initially, the Army intends to procure the AGS as a nondevelopmental item (NDI), which will solve the near term problem for the contingency forces. To ensure the advantages of integrated development and commonality are fully explored, AGS has been added to the Armored Systems Modernization umbrella to provide essential warfighting capabilities for all types of forces and missions. In the mid to far term a new development for the AGS is being considered as the follow-on to the NDI AGS. This new development, if initiated, will bring emerging technologies together in the future to field an AGS with increased lethality, deployability, and survivability.

Question. The Army is currently working with three gun propulsion technologies: unicharge, liquid propellant, and electrothermal chemical. What are the benefits and shortfalls of each of these technologies?

Answer. The Army is considering three gun propulsion options for the 155mm extended range ordnance (ERO) cannon for the AFAS. Those options are unicharge (UNI), liquid propellant (LP), and electrothermal-chemical (ET–C). These candidates are being considered because they offer operational, performance, manpower, and logistical benefits for the next generation artillery system. They offer the potential for achieving greater system lethality through increased range (30km unassisted/40km assisted) and increased rates of fire (12–16 rds/min/5 min and 3–6 rds/min/indefinitely), as well as the ability to fire a four round time-on-target mission from a single howitzer. In that they each offer the capability of being handled/manipulated by autoloaders, they offer the potential to reduce the manpower requirements for the howitzer and resupply vehicle crews. Each also offers the potential for reducing the logistics burden associated with the production, load, assembly, and packaging of propellant through the ammunition supply train system to the howitzer. Finally, each candidate will contribute to the combat survivability of the howitzer since each will be required to comply with the DOD Insensitive Munitions standards before fielding.

The first candidate is a variation of the current family of bag propellants, unicharge. UNI is a powder based propellant configured as one to six identical charge increments. This option is an additive approach which allows the use of only the increments needed for the fire mission with no associated propellant waste. Current charges come in one configuration only, and if a portion of the charge is not required, it is removed and destroyed by burning. The unicharge increments will be stick and/or granular propellant, M–30A1, M–14 or one of the newer multi-base formulations, packaged in a combustible case. The rigid case with its snap-together configuration facilitates the ease of handling of the charges by either autoloaders, automated resupply systems, and/or a crewman.

The second candiate is liquid propellant. LP departs from the current powder propellants in that it is a bulk liquid, which is basically a fertilizer. The LP is envisioned to be bulk stored internal to the self-propelled howitzer, and in turn incrementally metered in quantities up to 14.2 liters, depending upon the range of the mission. All testing to date indicates that LP will meet insensitive munitions requirements. The LP approach utilizes a regenerative process which permits the initiation and continuation of combustion, pressure rise and continuation, throughout as the projectiles travel down the bore. This permits the tailoring of the pressure-time curve and soft launching of G sensitive projectiles. The incremental metering of propellant permits a virtual infinite zoning capability across most of the operational range fan of an LP howitzer.

The last candidate is electrothermal-chemical. ET–C propellant envisions the achievement of extended range capability through the combined energy potential of the chemical propellant, i.e. a working fluid, and an electrical charge. The propulsive capability of the ET–C propellant is vested from 70 to 95 percent in the chemical component and 5 to 30 percent in the electrical energy. The propulsion system uses electrical energy derived from the vehicle power plant. As conceived, the energy is stored in a capacitor based pulse power system which is discharged into the working fluid/propellant cartridge through a pulse forming network. The electrical discharge creates a hot ionized gas (plasma) within the working fluid which propells the projectile down the gun tube. Like LP, ET–C offers the potential for soft launch and infinite zoning. An operational ET–C weapon system will require a power generation package, a pulse shaping ability and a power storage package in addition to the traditional projectile handling systems.

Question. Since electrothermal/chemical is certainly the newest technology, are you planning on waiting until this is a proven technology before going ahead with full scale development of the AFAS?

Answer. The ideal approach for the AFAS and gun propulsion programs would be to continue development of each candidate into three separate ATTD's for as long as possible prior to a system FSD decision. That would afford the opportunity to conduct a system propellant "shoot-off" with the most mature propellant technology prior to the FSD decision point. The ET–C option is the least mature candidate and still requires considerable fundamental research prior to a demonstrator integration decision. The ET development program to date has demonstrated that prediction and control of the ET process has not yet been achieved; that viable working fluid solutions have not been formulated; that weaponizable power supplies, pulse shaping, and power storage components are not currently available; and that an artillery zoning approach has not been explored. The Army will conduct a two-step approach for proceeding with the AFAS technology demonstration with a propellant capability of meeting all of the user's performance requirements at the decision point, while retaining the option to integrate a more revolutionary technology should it demonstrate the same potential or greater in the intervening period.

Question. How does the Army justify the need for heavy forces when the threat most likely to be countered with heavy equipment has been reduced by changes in the Warsaw pact military alliance?

Answer. We expect that the threat forces in Europe will decrease in size as part of the Conventional Forces Europe negotiations and the potential activities in the Warsaw Pact countries. However, validated threat assessments by the Defense Intelligence Agency and the Central Intelligence Agency indicate that even with reduced forces the Soviet Union will still retain significant military capabilities with modern sophisticated weapons, and will most likely modernize more rapidly as a result of their smaller force.

This capability combined with a proliferation of Soviet and Western technologies and weapons throughout the world necessitates continued modernization of the U.S. heavy forces as the only feasible ground conventional force deterrent.

Question. What would be the effect on the 1991-1995 budgets if the Congress cancelled ASM in fiscal year 1991? Please provide this information by year and by appropriation.

Answer. If Congress denies requested FY 1991 funding for ASM Advanced Technology Transition Demonstration (ATTD) programs, i.e., Common Chassis (CCATTD), Combat Mobility Vehicle (CMV), and Advanced Field Artillery System (AFAS), it would result in a restructure of the ASM program; program delay of approximately 18 months; a delay in restarting tank production, after the layaway in the spring of 1993, by approximately 18 months; and a cost increase in the RDT&E appropriation of approximately $450 million in the years from FY 1992 to completion. All funds through FY 1995 are in the RDT&E appropriation.

[In millions of dollars]

	Fiscal year:—					To complete
	1991	1992	1993	1994	1995	
RDT&E:						
From	175.6	280.7	245.7	563.8	1083.3	1415.9
To	46.3	205.5	340.8	232.8	618.0	2807.1

BLOCK III TANK

Question. Why is a new tank needed?

Answer. Nothwithstanding the Soviets unilateral announcements and bilateral force reduction negotiations, the Soviets are modernizing their tank fleet and are expected to continue to do so. Current estimates project that the Soviets will field a new tank, FST III, by the end of the decade. Our Abrams does not possess the capabilities to counter the new threat, nor can it be upgraded to do so at an acceptable weight. This dictates that we field the Block III tank, within the Soviets' RDA cycle, in order to maintain worldwide technological superiority or we will place our ground forces at unacceptable risk on the battlefield. The tank is the centerpiece of the close combat fight. Therefore, it is imperative that it be modernized in terms of lethality, survivability, and mobility.

Question. What is the weight goal for the new tank—are there in fact both interim and long-term weight goals?

Answer. The weight goal for the Block III Tank as specified in the Request For Proposal to industry is 55 tons. The Block III Tank program will identify interim performance oriented goals and thresholds during each phase of development which must be demonstrated prior to each Milestone decision.

Question. What is the maximum weight allowed for the new tank in your RFP to industry in tons?

Answer. The maximum allowable weight for the new tank in the common chassis RFP is 62 tons with no more than 10% growth.

There is an aggressive Block III Tank weight reduction initiative with emphasis on using light composite subsystems, additional countermeasures, advanced armors, and trade-off studies to reduce this weight toward the desired goal. The use of modular armor designs allow improvements in strategic mobility. By removing the basic vehicle load (crews, ammo, fuel, etc) and part of the removable modular armor, a total of 10.2 tons can be removed, making the Block III tank deployable at 51.7 tons.

Question. Will this tank be significantly lighter than the current one?

Answer. Yes. The Block III Tank, at its maximum weight of 62 tons, will be significantly lighter than the current M1A2 tank at 68.5 tons. Furthermore, if the M1A2 Tank was protected to the same level as the Block III Tank, the M1A2 weight would increase to greater than 71 tons.

ADVANCED FIELD ARTILLERY SYSTEM (AFAS)

Question. The report accompanying the DOD Appropriations Act, 1990 states the Congressional expectation that a new artillery system—the Advanced Field Artillery System (AFAS)—will have one of the highest priorities under Heavy Force Modernization. What action have you taken to comply with our intent?

Answer. Activities planned in FY 1990/91 for AFAS include release of the Advanced Technology Transition Demonstrator (ATTD) request for proposal, the beginning of source selection for the AFAS ATTD, a Defense Acquisiton Board Milestone I decision, completion of liquid propellant gun propellant, the completion of unicharge propellant design, and completion of the propulsion evaluation plan.

Question. Will the AFAS have the highest priorities under Armored Systems Modernization?

Answer. All the Armored Systems Modernization (ASM) systems are critical to the combined arms capability of Army forces. ASM system development is based on both warfighting contribution and the maturity of necessary technology. AFAS is an entirely new cannon system capitalizing on leap-ahead technologies, and its development schedule is consistent with the state of artillery technology and supports the start of Full Scale Development (FSD) in 1995.

Question. How much is included in the fiscal year 1991 R&D budget for AFAS?

Answer. The AFAS R&D program for FY 1991 is funded at $3.8 million to initiate the critical artillery technology demonstration. The requested funding supports a single contractor who will develop his concept for a unicharge or liquid propulsion based ATTD and integrate it on a M109 surrogate chassis.

LINE OF SIGHT ANTI-TANK (LOSAT)

Question. Does the fiscal year 1991 budget adequately support Full Scale Development (FSD) of the LOSAT and how much is included in the budget for this project?

Answer. The LOSAT FY 1991 Budget includes Advanced Development funds in the amount of $22.009 million and $72.872 for Full

Scale Development. These amounts adequately support the FSD effort.

Question. The hypervelocity missile is the weapon of choice for LOSAT. What is the status of the hypervelocity missile development program, which ran into snags last year?

Answer. The Kinetic Energy Missile (previously HVM) program is now in the 23rd month of a 33 month advanced development contract. The test module and initial missiles were shipped to the range on 21 March 1990. Final software will be incorporated to begin preliminary calibration (non-guided) flights in May 1990. The formal test flights (guided) will begin July 1990 and complete in October 1990 to support a FSD decision in March 1991. LTV is the prime contractor, and Texas Instruments was hired as a major subcontractor to correct the major deficiencies in the Fire Control System encountered in the Joint Services HVM Program.

Question. What are your "fall-back" plans should the hypervelocity missile prove to be a dud?

Answer. The Army will conduct a competition for the LOSAT FSD in FY 1991. The prerequisites for successful contractors proposals will be a demonstrated, mature technical concept that will provide a lethality overmatch and necessary accuracy to deliver that capability. If KEM is successful, it is one of the leading technical candidates. If not, there are several other candidates that are avialable that the Army could use to arm the system.

MIRACL LASER

Question. The MIRACL (Mid-infrared Advanced Chemical Laser) laser is a test asset at the White Sands Missile Range which is being upgraded in a manner that might provide an ASAT capability.

What percentage of Soviet "low-earth-orbit" (LEO) satellites would this system be able to attack?

Answer. The precise lethality of the MIRACL/SLBD system has not been determined. The effectiveness of the system is dependent upon beam propagation characteristics (which have yet to be experimentally evaluated), the range to the target (both altitude and crossrange—which vary with each orbit), and the absorptivity of the target surface (which can only be estimated). The precise amount of energy required to damage a target is also uncertain. Current analysis indicates that some damage to satellites in the lowest orbits might be possible. Experiments conducted after the MIRACL upgrade will assist in narrowing some of these uncertainties.

Question. What is the total cost to provide MIRACL with ASAT capability?

Answer. The costs vary significantly with the degree of capability required. The current $20 million upgrade is to develop and test key components and investigate beam propagation characteristics. Even if subsequent testing shows damaging power levels can be obtained, there are significant limitations which preclude MIRACL/SLBD from being considered an ASAT weapon. In addition to power limitations and the lack of the battle management/command, control and communications systems required for a weapon;

there is a significant start-up time required for the device, very limited fuel resources on-site, no spares for many key components, and a long recycle time between shots. In addition, the system is only capable of tracking targets in a terminator mode, limiting engagement opportunities to two hours in the morning and evening. The MIRACL/SLBD is primarily intended as an R&D device.

Question. What would be the next logical step after deploying a MIRACL ASAT—to build additional sites?

Answer. MIRACL is an R&D system and is not intended for deployment. There are no plans or funds to upgrade this system for operational deployment. As an R&D system, MIRACL is intended to resolve key technology issues required to field an actual ASAT weapon. The Office of the Secretary of Defense will select among competing Army and Air Force concepts for a ground-based laser ASAT no earlier than Fiscal Year 1991.

ADVANCED ANTITANK WEAPON SYSTEM-MEDIUM (AAWS-M)

Question. The Advanced Antitank Weapon System—Medium, or AAWS-M, is a joint program with the Marine Corps to replace the DRAGON, the current medium antitank weapon system. A full scale development contract was awarded on June 21, 1989.

The report accompanying the DOD Appropriation Act, 1990, included language "fencing" $2.5 million of the AAWS-M funding for the development of an interlock device.

How much of the $2.5 million have you obligated and expended for the interlock device?

Answer. In accordance with last year's language, the AAWS-M Full Scale Development contract was modified to require the contractor to conduct a lock out device capability study. The contractor has completed his study and the AAWS-M project office is staffing the study with the user. We expect the study results to be forwarded to HQ DA by the middle of April. Thus far, we have expended $250,000 of the funds provided.

Question. Is it our understanding that the initial funding identified by the Armed Services Committees to perform a shoot off between other antitank systems has expired. If so, what are the Army's plans for alternate funding to do these tests? If funds are reprogrammed, what will be the source(s)?

Answer. The problem here is not the source from which to reprogram funds. The law specified the sources from which funding for these tests must come. Congress directed that—FY 1988 MILAN and Bofors BILL tests funds, Dragon III funds from the terminated DRAGON III contract and other FY 1988/89 funds available to the Secretary of the Army be used. The FY 1988 MILAN and BILL test funds have expired and can no longer be obligated. The DRAGON III funds were transferred to the USMC in FY 1989 and are committed to contract termination liability costs. Because neither the MILAN test funds nor the Dragon III funds were available, the Army submitted a reprogramming request to OSD on 17 January 90 requesting approval to use FY 1990 dollars to fund the first increment of the SIMATS tests. OSD disapproved the Army request for reprogramming on 8 February citing the FY 1989 National Defense Authorization Act directive that FY 1988 or FY 1989 dollars be used to fund the SIMATS tests.

The Army opted to request reprogramming authority to use FY 1990 funds instead of FY 1989 funds because of the length of the tests and the fact that FY 1989 RDTE funds expire in September of this year. A test of this magnitude cannot be executed with funds that expire in September of 1990. The Army will require relief from the statutory requirement to use FY 1989 funds for these tests. Subsequent to that, Congress will have to either appropriate funds for these tests or will have to approve a reprogramming action.

Question. What is the total cost of performing these tests?

Answer. To fully comply with the law's (Section 254 of the FY 1990 National Defense Authorization Act) requirements to "identically" repeat the side-by-side test in accordance with the test and criteria established in SEC 114 of the FY 1989 National Defense Authorization Act and to satisfy the gunner survivability concerns reported to Congress by the Department of Defense Director of Operational Test and Evaluation last year, it would take approximately $24 million dollars. However, we could reduce this cost substantially if the law were not so specific in its requirement to identically repeat all the previously conducted technical and operational tests.

Question. After funds are identified, how long do you anticipate these tests will take to complete?

Answer. We have looked into this. The fastest way to get started would be by using a letter contract to procure the systems to be tested. Under ideal conditions we could expect to take delivery of the required systems to be tested seven (7) months after we receive funding. After we receive the missile systems, it would take approximately eight (8) months to conduct the required technical and operational tests and four (4) to five (5) months to evaluate the raw data, write the report and forward it to Congress. The end result is that it would take approximately nineteen (19) to twenty (20) months from the time we have funding available until the report is available to Congress.

Question. What is the funding level for AAWS-M in the fiscal year 1991 budget request and does this level fully fund the original IOC?

Answer. The FY 1991 budget request is for $76.8 million in Research and Development funds to continue the Full Scale Development effort and for $15.5 million in procurement to purchase long lead items necessary to begin Low Rate Initial Production (LRIP) in FY 1992. These funds fully support the planned IOC.

Question. Is AAWS-M fully funded in the Five Year Defense Plan (FYDP)?

Answer. Yes, both research and development and procurement for AAWS-M are fully funded in the FYDP.

FOLLOW-ON TO LANCE (FOTL)

Question. The fiscal year 1991 budget includes $112 million in R&D for the Follow-on-to-Lance (FOTL). This is nearly triple the fiscal year 1990 level ($32.8 million). What are your fiscal year 1991 plans for FOTL?

Answer. Fiscal year 1991 is the first year of Full Scale Engineering Development for FOTL. As such, the activities in this year will focus on: definition/allocation of requirements, preliminary hardware/software design, procurement and test of components and subassemblies, conduct on nuclear surety and safety criticality analysis, concurrent engineering of Reliability, Availability and Maintainability (RAM), Producibility, Engineering, and Planning (PEP), and Manpower and Personnel Integration (MANPRINT) attributes to the FOTL design. FY 1991 will also include integration of the FOTL missile with the DOE warhead and the M270 launcher. The funding request of $112.2 million represents a full year of contract effort versus only three months of contract effort contained in the FY90 program.

Question. Considering the political climate in Germany and the unwillingness of the German Government to allow the positioning of the FOTL in their country, what is the future of this system?

Answer. A deployment decision for this system is scheduled to be made by NATO in FY 1992. Even in light of the changes that are occurring in Europe and elsewhere, the concept of flexible response remains a valid doctrine for the U.S. Capable survivable, short-range nuclear forces (SNF), such as Follow-On to Lance, perform an extremely valuable deterrent function and provide linkage between our conventional forces and the national strategic arsenal. SNF serve as both a hedge against the possibility of a regenerated Soviet conventional threat and as a deterrent to regional nuclear capable powers. Post CFE, the Soviets will still retain large, powerful conventional forces. Developing nations already possess ballistic missiles, chemical weapons and could develop nuclear weapons within 10 years.

At the May 1989 North Atlantic Council meeting, every NATO country endorsed the Comprehensive Concept of Arms Control and disarmament. This Concept recognizes the need for robust and capable nuclear forces in Europe, acknowledges the value of continuing funding by the U.S. of research and development for FOTL and agrees to defer a FOTL deployment decision until 1992. In 1992, overall security developments in Europe will be re-evaluated. Failure to proceed with FOTL development will result in a defacto third zero of NATO (and ultimately U.S.) tactical surface-to-surface (SSM) capability. It will remove pressure on the Soviets to reduce the number of their SNF SSM launchers which now totals over 1,100, as compared to NATO's 88.

The need for FOTL is not limited to Europe. In addition to SACEUR, CINCPAC and CINCCENT, also have established requirements for a lethal, accurate and survivable nuclear SSM that will replace the aging LANCE. Worldwide, wherever U.S. land forces may be committed, military commanders require a system like FOTL to deter an attacker's first use of weapons for mass destruction and as a means of preventing the collapse of our conventional defense.

Question. When would production begin?

Answer. The FOTL production is planned to begin in FY 1992 with procurement of Long Lead-time Items in order to meet the

SACEUR Operational Capability (IOC). Low Rate Initial Production is planned to begin in FY 1993.

Question. How much is included in your Five Year Defense Plan (FYDP) for procurement of FOTL?

Answer. The FY 1991 Budget Estimate contained $418.2 million through FY 1994 for procurement of 342 FOTL missiles. As a part of the upcoming program review, the amount for procurement of FOTL will be re-examined.

Question. What is the total development cost for FOTL and how does this compare with the original estimate?

Answer. The formal cost estimate (called the Single Best Estimate) for FOTL was recently completed. The estimated cost for development of FOTL was $511.2 million. This cost estimate will be revised after receipt of contractor proposals and prior to the Full Scale Development decision. This updated estimate will become the Baseline Cost estimate, will form the Program Baseline and be reported in the Selected Acquisition Report (SAR). Cost estimates are not expected to change significantly.

Question. If Congress terminates FOTL, what alternatives exist for the Army?

Answer. Retention of LANCE is an alternative, but not desirable, ———.

Question. What about highly accurate conventional systems?

Answer. Conventional deep attack systems now in production and under development will provide a needed and enhanced capability for the attack of fixed and mobile targets within the Corps area of responsibility. However, they will not have the range nor the capability against hardened targets such as hardened command posts, and other deeper targets that are of interest to the Army Group or Theater Commander. Conventional systems do not provide the required nuclear deterence link to strategic systems that is inherent in tactical nuclear weapons.

Question. What is the obligation status of fiscal year FOTL funds?

Answer. Of the $32.3 million appropriated for FOTL in FY 1990, $6.6 million has been obligated and $3.999 million has been reprogrammed for other Army uses. An additional $10.2 million is expected to be obligated by the end of 3rd quarter FY 1990. The remaining $11.5 million is planned for obligation in the 4th quarter of FY 1990.

ARMED AHIP

Question. The fiscal year 1991 budget request includes $25.8 million in RDT&E and $13.8 million in Procurement for a program to "arm" nine OH-58D AHIP aircraft with both Stinger and Hellfire missiles. The total program cost for AHIP modification is $655.2 million: $45.2 million in RDT&E and $610 million in procurement. Please explain the need for this program.

Answer. The armed OH-58D (KIOWA WARRIOR) program solves several Army needs. First and foremost, it will provide an interim solution to Army Aviation's most critical deficiency, the inability of Air Cavalry units to see and fight at night. Second, it provides a deployable, versatile and lethal aviation capability to contingency forces for "forced entry" operations. Third, it reduces an unacceptable long-term capability and procurement risk (time lag till Light Helicopter (LH) fielding) to acceptable short-term levels with a combat proven (Persian Gulf) modification to a Field Army respected aircraft (OH-58D). Fourth, the aircraft enhances combat survivability in serial reconnaissance missions with the terrain masking (concealment) and extended stand-off capability of the Mast Mounted Sight (MMS). Fifth, it supports the Army Aviation Modernization Plan (AAMP) by modernizing a portion of the fleet. Sixth, it reduces aircraft requirements, as eight KIOWA WARRIOR's will replace ten aircraft. Seventh, it reduces Operational and Sustainment (O&S) costs and standardizes personnel and logistics support requirements, as one KIOWA WARRIOR will replace two types of Army aircraft (OH-58A/C and AH-1). Eighth, it speeds the retirement of aging aircraft in the fleet. Overall, the KIOWA WARRIOR program is an extremely low risk program with multiple dividends.

Question. Of the $610 million for procurement, only $168.8 million is for the "armed" package of the OH-58D. Why do you need the additional $441.2 million to modify the aircraft?

Answer. The $441.2 million is needed to attain the necessary aircraft configuration on previously fielded OH-58D aircraft to accept the armed modification. In order to add air-to-ground weapons to the currently approved fleet of 243 OH-58D aircraft, previously fielded OH-58D's (195) must be retrofitted to the "armed" production configuration. The $168.8 million represents the procurement costs for Hellfire, 2.75 inch rocket, and .50 caliber machine gun systems (excluding ammunition); upgraded transmission; upgraded engine and Multipurpose Light Helicopter (MPLH) kits; i.e., those items strictly associated with the KIOWA WARRIOR (Armed OH-58D/MPLH) modification. The $441.2 million represents procurement costs for retrofit modifications of previously fielded aircraft (wiring, hardpoints, weapons pylons, Air-to-Air Stinger, enhanced processors and electronics integration, data loader, laser warning devices, SINCGARS radios, M-43 mask and other previously approved product improvements). The remaining 48 aircraft will not require retrofit in accordance with Fiscal Year 1989 Authorization Conference Report language (100-989, page 226) which directed provisioning fiscal year 1989 and subsequent aircraft for the armed modification on the production line.

Question. With the arming of the OH-58D, what mission is left for the LHX.

Answer. There is no conflict in mission between armed OH-58D's (KIOWA WARRIOR) and LH's. KIOWA WARRIORs are the near term solution for Army aviation's most critical deficiency, the inability of Air Cavalry units to "see and fight" at night. LH's are the long-term answer to this deficiency. The program to additionally arm 243 OH-58D's with air-to-ground weapons will conclude in mid-Fiscal Year 1996. LH production starts in Fiscal Year 1995 with first delivery in Fiscal Year 1996 and Initial Operational Capability (IOC) in Fiscal Year 1997. Additionally, the armed OH-58D/Multi-Purpose Light Helicopter (MPLH) aircraft fills an immediate need in contingency forces for support to "forced entry" missions. The KIOWA WARRIOR has a 20 plus year life expectancy and is scheduled for transfer to Reserve Components when replaced by LHs.

Question. The mission of the OH-58D is not to attack, but to scout for targets and relay this information to the attack platforms. Has the Army changed its war-fighting doctrine—is that why it needs an attack-scout helicopter?

Answer. The Army has not changed its war-fighting doctrine. Prior to December, 1989, the OH-58D was solely procured and fielded for a Field Artillery Aerial Observer role. In that role, its mission involved targeting for artillery. During contingency operations in the Persian Gulf, a need arose for an aircraft that could perform aerial reconnaissance and deliver air-to-air and air-to-ground munitions. Within a five month total procurement cycle and a production time of less than 100 days, 15 OH-58D's were converted to an armed configuration (Prime Chance Aircraft). In August, 1988, the Deputy Secretary of Defense, based on the Army Aerial Scout Test, certified the OH-58D as the most cost effective scout helicopter for the Army air cavalry/reconnaissance mission. In December, 1989, the Secretary of the Army directed that all 243 OH-58D's be armed and transferred to the reconnaissance/cavalry role. Current distribution plans for these aircraft call for assignment to contingency forces and high priority, forward deployed cavalry squadrons. The inherent versatility of the aircraft will allow the conduct of armed reconnaissance missions with one type of airframe versus the current requirement of two aircraft (OH-58A/C and AH-1). In all other aviation attack units, the scout/attack aircraft mix will remain.

LONGBOW

Question. The Longbow is a mast mounted system which consists of a fire control radar and radio frequency Hellfire missile seeker. Longbow will be mounted on the AH-64 Apache and will provide all weather and true fire-and-forget capabilities. Total R&D program cost for Longbow is estimated at $400 million while production is estimated at $4.2 billion (aircraft and missiles).

Why have the estimated outyear procurement quantities of the Longbow been reduced by approximately one-third (322 to 227)? What is the effect on program costs, particularly Longbow production unit costs?

Answer. Longbow procurement quantity has been reduced from 322 to 227 systems primarily to accommodate an adjustment in Force Package 1. The Army plans to modernize forces by force packages with Force Package 1 receiving the highest priority. Also, the adjustment coincides, for the most part, with a reduction in the procurement objective for the AH-64 Apache from 975 to 807 aircraft.

The effect of the quantity reduction on unit costs, flyaway and procurement, are indicated below:

FCR—Fire Control Radar
RFHM—Radio Frequency Hellfire Missile

CONSTANT FISCAL YEAR 1990 DOLLARS

[In millions of dollars]

	Unit flyaway cost	Unit procurement cost
322 FCR	1.589	1.743
227 FCR	1.794	1.984
Difference	+.205	+.241
15,456 RFHM	N/A	.122
10,896 RFHM	N/A	.115
Difference	N/A	(.007)

[In millions of dollars, escalated]

	Total procurement	Unit procurement cost
322 FCR	645.0	2.003
227 FCR	548.0	2.414
Difference	(97.0)	+.411
15,456 RFHM	2,232.0	.144
10,896 RFHM	1,559.0	.150
Difference	(673.0)	+.006

The change in unit cost of the RF is due primarily to program restructuring and continuing refinement of baseline cost estimates more so than the quantity adjustment.

Question. Is Longbow still affordable?

Answer. Prior analytical efforts and emerging results from ongoing cost and operational effectiveness analyses indicate that Longbow's contribution to the AH-64 Apache and to the new Light Helicopter (LH) in terms of lethality and survivability make Longbow an extremely cost effective weapon system.

Question. The Army had originally planned dual source production. Since the total number of systems to be purchased has been reduced, the Army plans to now select just one contractor. What effect will this change have on the cost of the program?

Answer. The dual sourcing acquisition strategy was predicated on quantities of 322 fire control radars (FCR) and 15,456 missiles. These quantities were the minimum necessary to make dual sourcing economically viable. Lowering quantities to 227 FCR's and 10,896 missiles drives the Army to a strategy of downselecting to one contractor at the beginning of full rate production. Selecting one contractor at the lower quantities realizes a savings of $30 million for the FCR and $166 million for the missile over dual sourcing at those lower quantities.

Question. There have been some problems with fielded AH-64s, including reliability and operational readiness shortfalls. Will the Longbow enhance the operational capability of the Apache?

Answer. Integration of Longbow into the Apache entails airframe modifications necessary to effectively and efficiently integrate Longbow. Those airframe modifications are being designed with reliability enhancements in mind. Examples are: elimination of the shaft driven compressor (a traditional reliability driver), thirty percent greater cooling for black boxes, reduction in the amount of wiring and number of connectors in the aircraft and redundancy of generators, processors and data buses.

Question. If not, what is the utility of placing Longbow on the Apache?

Answer. Answer not required due to response above.

Question. What are your plans for including the Longbow system on the LHX?

Answer. Longbow will be integrated onto the Light Helicopter (LH) as a pre-planned product improvement beginning with production Lot 4. Initial fielding of Longbow LH should begin in 1999. Approximately 700 Longbow LH's will be procured.

Question. What are the major schedule milestones for this program and how do they compare to the original estimate?

Answer.

Milestone	Previous	Current
Award IDP contract	August 1989	September 1989.
Milestone II	May 1990	May 1990.
Award FSC contract	October 1990	October 1990.
Milestone IIIa	October 1992	October 1992.
LRIP contract award	November 1992	April 1993.
First production delivery (FCR)	October 1993	August 1994.
IOT&E complete	August 1993	May 1994.
Milestone III	November 1993	February 1995.
Fielding	1996	Plus 10 months.

FIBER OPTIC GUIDED MISSILE (FOG-M)

Question. The fiscal year 1991 budget request eliminates procurement of the Non-Line of Sight FOG-M but supports continued R&D. In fiscal year 1991, $99 million is requested for FOG-M RDT&E. What are your plans for R&D in fiscal year 1991?

Answer. During fiscal year 1991 the Fiber Optic Guided Missile FOG-M will undergo Engineering development testing by the contractor. This testing will verify the systems design and performance. Once this testing is completed then System qualification testing will take place to verify the system is ready to begin production.

Question. What is the rationale for continuing R&D on a program which the Army has decided it does not want to buy?

Answer. The Army still intends to buy the Fiber Optic Guided Missile as the requirement to defeat the masked standoff helicopter threat still exists. This effort also allows further development of a key technology, fiber optic cable, to continue.

Question. It is our understanding that the contractor for FOG-M underestimated its development cost and does not currently have sufficient funds budgeted to complete this program. Are you aware of this situation, and what is its effect on the Army's program costs?

Answer. Yes, the Army is well aware of the issue and the program has sufficient funds budgeted to complete the effort.

Question. What are the major milestones for this program, and how do they compare to the original estimate?

Answer. The major milestones for this program are:

Milestone	Current estimate	Original estimate
Engineering development test	November 1990	November 1990.
Low rate production start	N/A	July 1991
Early user test & experimentation	January 1992	January 1992.
Initial operational test & evaluation (IOT&E)	July 1993	October 1993

Question. Is other FOG-M missile technology work funded in the fiscal year 1991 RDT&E request, and why is this necessary?

Answer. No other FOG-M missile technology work is funded in the fiscal year 1991 RDT&E budget request.

Question. How much FOG-M production funding is currently in your Five Year Defense Plan (FYDP)?

Answer. In the FY 1991 budget submission the Army fully supported the continuation of the full scale development effort for the fiber optic guided missile (FOG-M) and canceled the planned start of low rate production in fiscal year 1991. This allowed the program to be restructured so that development and testing were completed prior to the production decision being made. The Army remains committed to start full scale production in FY 1994. The planned buy is for 502 fire units and 16,931 missiles at an estimated cost of $2.3 billion thru fiscal year 2001.

STINGER MISSILE

Question. Last year the Army experienced performance problems with its Reprogrammable Microprocessor (RMP) missile system. During testing, the RMP was not performing to contract specifications and for awhile the Army refused to accept delivery of RMP missiles from the prime contractor.

Was any additional R&D required to fix the RMP system? If so, how much was needed?

Answer. No Army RDTE funds were required. The contractor, General Dynamics is contractually responsible to meet lethality contract specifications and is working on the fix at its own expense.

Question. Are there any R&D funds in the 1991 budget request for Stinger-RMP?

Answer. The Army did not request any RDTE funds for RMP in its FY 1991 budget.

Question. A February 18, 1990 letter from Secretary Stone states that the Army is accepting delivery of the STINGER-RMP because the missile now meets all performance requirements in effect at the time of acceptance, except the requirement for lethality.

Isn't the lethality of the weapon an important performance requirement which should be met before the missile is accepted by the Army?

Answer. Lethality of the RMP is an important performance requirement and is contractually mandated by the STINGER-RMP Engineering Development (ED) contract. Compliance is demonstrated through a performance assessment using lethality requirements for benign and various IRCM scenarios. The lethality of the system is dependent upon the ability of software to guide the missile to intercept. The RMP places key guidance functions under software control located in an external reprogrammable module in the missile launcher (gripstock). Therefore, RMP software upgrades are expected to increase lethality to meet requirements.

The Army notified Congress in a 22 June 1989 OASA RDA memorandum that it had decided to begin accepting STINGER-RMP missiles. That decision was based upon the proven reprogrammable aspect of the RMP and positive test results. The missile met all performance requirements, including the user's system effectiveness requirement, except for the RDTE contract lethality requirement. The RMP missile failed to meet the lethality requirement in a portion of advanced countermeasure threat for a specific aircraft in specific engagement scenarios.

Because General Dynamics failed to meet all RDT&E contract requirements, the Army made the acceptance of the STINGER-RMP conditional.

The conditions under which the Army accepted the missiles are: General Dynamics continue its effort to comply with engineering development contract requirements, to include software modifications, with no increase in contract price; General Dynamics will retrofit fielded STINGER-RMP modules at their own expense; and only partial payment be made for accepted missiles until the engineering development contract is completed. Contracts were modified to reflect this agreement.

The Army began accepting RMP missiles on 17 July 1989. Approximately 2,209 missiles (all Services) were accepted prior to the Army stopping missile acceptance in November 1989 as mandated by the 1990 Defense Authorization Act. Mr. Stone's 28 February 1990 memorandum informing Congress that the Army will reinitiate the acceptance of missiles complies with the intent of Congress expressed in Public Law 101-189.

Present development efforts in the software area have demonstrated that necessary progress is being made to meet a contractual lethality requirements. Demonstrations to date include a quick look assessment on the hybrid simulation by U.S. Army Missile Command Research Development Engineering Center of updated software and the Engineering Flight Test Program which has completed 3 successful tests. The final assessment of lethality will be accomplished on the hybrid simulation during performance assessment expected to be completed by 31 July 1990. Confidence developed to date by the above demonstrations has supported the continuance of acceptance of the STINGER-RMP missile.

SENSE AND DESTROY ARMOR (SADARM)

Question. This project is designed for both the Multiple Launch Rocket System (MLRS) and the 155mm Howitzer and will provide an ability for both systems to attack targets beyond the Forward

Line of Troops. In fiscal year 1991, $105.5 million in R&D is requested for SADARM. Have you looked at the option of limiting SADARM to only one system, either the MLRS or the 155mm?

Answer. This project is designed for both the Multiple Launch Rocket System (MLRS) and the 155mm Howitzer and will provide an ability for both systems to attack targets beyhond the Forward Line of Troops. If we are to fulfill the operational requirement, neither sole system option can be considered acceptable as even buying additional quantities of one does not offset the loss of the other carrier. MLRS supports only the heavy forces and functions primarily as the counterbattery weapon of choice whereas the 155mm howitzer is proliferated throughout the force (light and heavy) and is the only counterbattery capability for the light forces.

IMPROVED RECOVERY VEHICLE

Question. The DoD Appropriations Act, 1990, included a legislative provision requiring the Army to complete technical and operational testing and acquire the technical data package for the Improved Recovery Vehicle, M88A2. Is the Army complying with this requirement?

Answer. Yes, the Army Tank Automotive Command has developed a test program plan to execute technical and operational testing, leading to acquisition of the technical data package for the Improved Recovery Vehicle (IRV). Preliminary actions to transfer accountability of prototype vehicles and release funding to the Tank Automotive Command have been completed. Funding to accomplish the test program and acquisition of the technical data package is estimated at $22.232 million. Funding requirements exceed the $15 million of FY89 IRV procurement funds, allocated to Congress to accomplish the legislative provision, by $7.232 million. A reprogramming will be required to provide the necessary funding to accomplish the legislative provision. A new contract must be negotiated with BMY Corporation and prototype vehicles must be refurbished, prior to start of testing.

Question. What are the current milestones?

Answer. Current milestones are as follows:

Request for Proposal released by the Army, May 1990.

Contract award, September 1990.

Begin baseline testing, January 1991.

Begin performance, reliability and operational testing, March 1991.

Complete testing November 1991.

Complete test data evaluation and test report/decision on technical data package January 1992.

Question. Congress also directed the Army to report by March 31 on the nature and extent of deficiencies in the current approved practices and procedure for recovery of armed vehicles. What is the status of this report and what can you tell us about the position the Army will take in this report?

Answer. The Training and Doctrine Command (TRADOC) has prepared a draft report which is currently being staffed at HQDA. It is anticipated that this report will acknowledge the requirement for an improved recovery vehicle, and outline short term and long term alternatives in light of results of test of the M88A1E1, future force structure, available funding, and future priority of an IRV in the Battlefield Development Plan (BDP) and Long Range Research, Development, and Acquisition Plan (LRRDAP). It is anticipated that in the long range, the report will propose the fielding of an Armored System Modernization (ASM) recovery variant capable of supporting the ASM fleet.

AIDS RESEARCH

Question. The fiscal year 1991 budget request for AIDS research is $22.558 million. Research on AIDS is a program of special interest to Congress and therefore, money has been added in the past few years to ensure appropriate emphasis is placed on this research. This is the first year that a budget request has included funds for AIDS research.

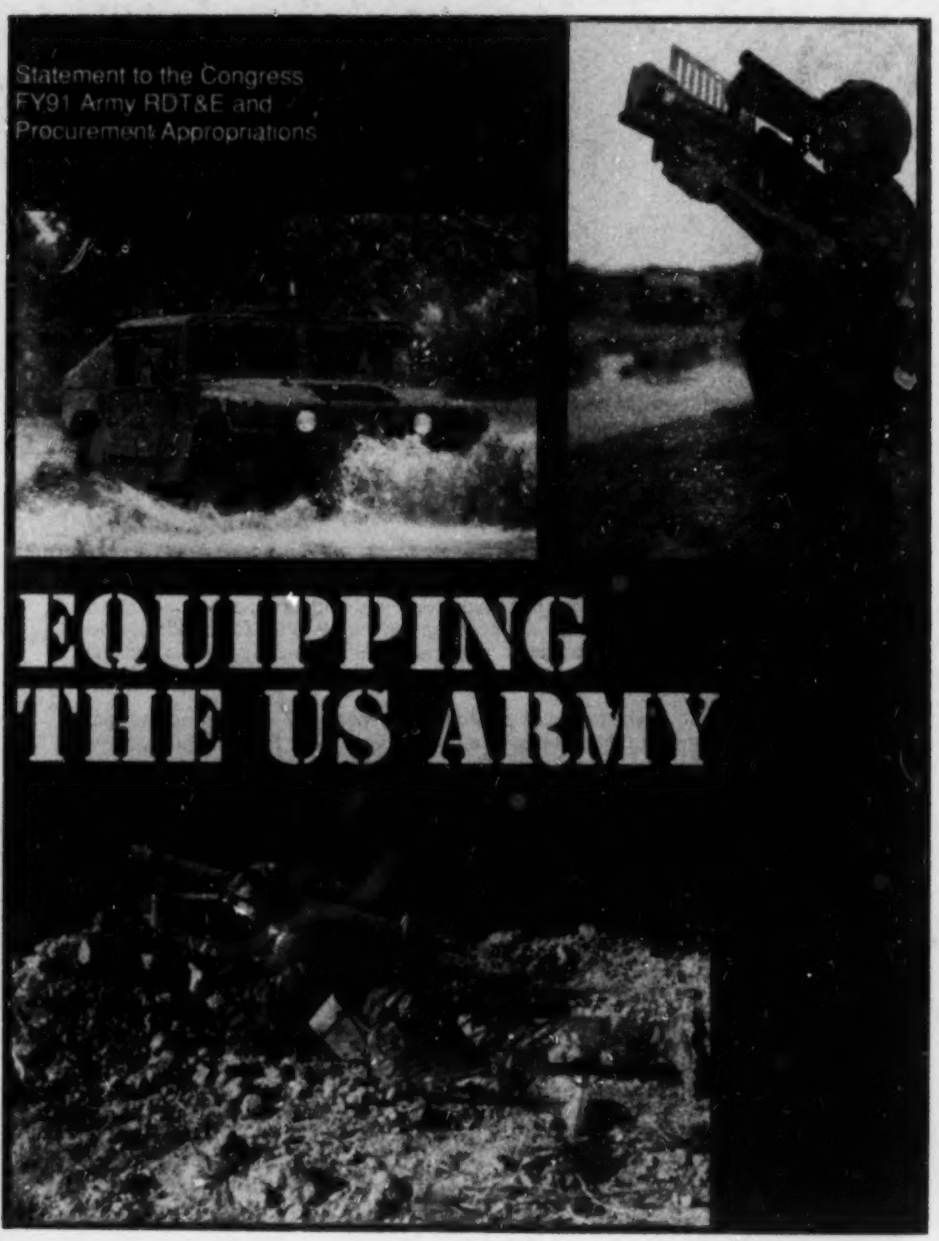
Additionally, the description of this program states, "This is a continuing program." Does this mean that we will continue to see the Army budgeting for AIDS research?

Answer. In fiscal year 1988 and 1989, the President's budget included a request for funds for AIDS research. At this time, the Army has programmed for continuing and adequate HIV/AIDS research funding which will sustain the current level of effort, constrained by future Army research and development budget priorities.

Question. One of the projects planned for fiscal year 1991, is the development of a model which will track the financial impact of AIDS on active duty personnel. Please tell us a little more about the model.

Answer. The Army has developed a computer model which will project the financial impact upon the Army. There is no known model which tracks the financial impact upon the individual soldier. Known data about the morbidity, mortality, costs for medical care, and other epidemiological information have been used in the development of the model. The model considers the expected rate of disease progression, incidence of disease, and medical costs at each stage of progression. The costs for the Army are then generalized to the Department of Defense based upon observed rates across the services. A fair amount of precision can be expected from the statistical output unless there are abrupt medical discoveries or breakthroughs which would alter the current therapies.

[Clerk's note.—End of questions submitted for the record. The joint Fiscal Year 1991 Army RDT&E and Procurement Statement as referred to on page 122 follows:]



Statement to the Congress
FY91 Army RDT&E and
Procurement Appropriations

EQUIPPING THE US ARMY

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0103

March 1, 1990

Members of Congress:

In building the fiscal year 1991 budget request we have made decisions with a cost-disciplined eye. Our decisions were based on operational requirements, projected force structure reductions and relocations, and a cautious awareness of changing world political realities. We have chosen to stop production of several major systems while continuing to procure those systems needed to give us a well-rounded fully modernized, albeit smaller, force. As a result, we have had to make substantial modifications to our modernization plans, but we will be able to continue to field a force capable of remaining competitive with our potential adversaries.

Over the past decade, with the support and assistance of the Congress, we have made major strides in modernizing our Army. We believe that the resulting strength of our force has paid a dividend in deterrence for the nation. We solicit your continued support as we endeavor to continue our modernization at a pace consistent with the ongoing reordering of our national priorities.

The statement which follows provides descriptions of many of our weapon system programs and the content of our fiscal year 1991 RDA budget request. The final chapter contains the actual budget numbers for the systems, arranged by appropriation. In addition to this statement, we are making available to you the 1990 Army Weapon Systems Handbook, a consolidated reference for a number of our major weapon systems.

It is an honor to represent the Army before the second session of the 101st Congress. We hope that our testimony will assist you in your decisions on the Army budget for fiscal year 1991.

Donald S Pihl

Donald S. Pihl
Lieutenant General, GS
Military Deputy to the
Assistant Secretary of the
Army (Research, Development
and Acquisition)

Stephen K. Conver
Assistant Secretary of the Army
(Research, Development and Acquisition)

Honorable Stephen K. Conver
Assistant Secretary of the Army for Research, Development, and Acquisition

Stephen K. Conver was nominated by President George Bush to be the Assistant Secretary of the Army for Research, Development, and Acquisition in December 1989.

In this capacity, Mr. Conver functions as the Army Acquisition Executive with responsibility for Research, Development, Test,, and Evaluation programs; procurement programs; development of acquisition policies and procedures; and implementing worldwide security assistance policies.

Mr. Conver previously served on the professional staff of the House Armed Services Committee as the principal defense advisor to Congressman Bill Dickinson (the ranking Republican) and the twenty-one other Republican members of the HASC.

Prior to joining the Armed Services Committee in December 1985, Mr. Conver served for four years on the staff of the.Secretary of the Air Force as Deputy Assistant Secretary (Programs and Budgets). In this position, he was responsible for overseeing the development, approval, and executionof the Service budget.

Between 1975 and 1981, Mr. Conver held several positions with the U.S. Nuclear Regulatory Commission, beginning as an operations analyst and progressing to Chief of Analysis and Planning for the agency.

After receiving his Bachelor of Science degree from the U.S. Air Force Academy in 1966, Mr. Conver served for nine years as a commissioned officer in the Air Force. He earned a Master's Degree in Operations Research from Ohio State University in 1970. Mr. Conver's military experience covered a broad range of subjects, including long-range planning studies in support of advanced weapons acquisitions, technical analysis of Soviet weapon systems, and analysis of the U.S. strategic force structure.

Mr. Conver was born in Memphis, Tennessee and grew up in Cincinnati, Ohio. He presently resides in Great Falls, Virginia with his wife Nan and his sons Brad and Andy. His hobbies include running, golf, and youth basketball.

Lieutenant General Donald S. Pihl

Military Deputy to the Assistant Secretary of the Army (Research, Development and Acquisition)

Lieutenant General Don Pihl was born in San Francisco, California, on 18 August 1937. He was commissioned a second lieutenant in Armor through the Reserve Officer Training Corps Program upon graduation from the University of California at Berkeley in 1959. He earned a Bachelor of Science degree in Business Administration and later a Masters in Business Administration. His military schooling includes the Armor Officer Basic Course at Fort Knox, Kentucky, the Quartermaster Career Course at Fort Lee, Virginia, the Armed Forces Staff College at Norfolk, Virginia and the Army War College at Carlisle Barracks, Pennsylvania.

General Pihl held various troop and squadron positions with the 25th Infantry Division, United States Army, Pacific, after which he was assigned to Korea and commanded a company in Eighth Army. On returning to the United States, he was assigned to the Combat Developments Experimentation Command at Fort Ord, California, as a Contracting Officer. General Pihl served as the Aide-de-Camp to the Commanding General, United States Army Test and Evaluation Command, Aberdeen Proving Ground, Maryland. General Pihl was assigned as S1 (Personnel) in the 16th Armor Group at Fort Knox, Kentucky. This was followed by a tour as Executive Officer, 4th Battalion, 37th Armor at Fort Knox, Kentucky. He was assigned as Executive Officer, 1st Battalion, 77th Armor at Fort Carson, Colorado and for a year with the same unit in Vietnam. General Pihl was assigned as an Operations Research Analyst in the Office of the Assistant Vice Chief of Staff, Department of the Army, Washington, D.C. He was the Military Assistant to Secretaries of the Army Resor and Froehlke. General Pihl commanded the 3d Squadron, 11th Armored Cavalry Regiment, United States Army, Europe. He was assigned to the Training and Doctrine Command, Division Restructuring Study Group and later as the Chairman of the Combat Developments Planning Group at Fort Monroe, Virginia. General Pihl commanded the 3d Brigade, 3d Armored Division (Spearhead) at Friedberg, West Germany. Remaining in Europe, he served as the Chief of Staff, 3d Armored Division (Spearhead) in Frankfurt. General Pihl became the Deputy Director of Weapon Systems, and later was reassigned as Director of Combat Support Systems in the Office of the Deputy Chief of Staff for Research, Development and Acquisition, Headquarters, Department of the Army, Washington, D.C. Prior to assuming his present position, General Pihl was the Commanding General of the 9th Infantry Division (Motorized), Fort Lewis, Washington.

General Pihl's decorations include the Distinguished Service Medal, the Legion of Merit (with Oak Leaf Cluster), the Bronze Star Medal for valor (with Oak Leaf Cluster), the Purple Heart, the Meritorious Service Medal, the Army Commendation Medal (with two Oak Leaf Clusters), and the Combat Infantryman Badge.

He is married to the former Sandra Young. They have two sons, Douglas and Gregory, and one daughter, Victoria.

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INTRODUCTION

The Army is pleased to submit this request to Congress for the fiscal year 1991 budget for research, development, and acquisition. This budget requests a total of over sixteen billion dollars, $10.6B for procurement of hardware systems and $6.0B for research and development to insure that technology and equipment is developed and present for use in future systems. The Army has succeeded in substantially modernizing its equipment in the past decade. Our goal for the future is to continue to ensure that our soldiers are adequately equipped through the 1990's and beyond through good stewardship of the resources provided.

The research, development, and acquisition community has direct responsibility for two of the six imperatives that the Chief of Staff of the Army presented to Congress earlier as the requirements for maintaining a ready Army. These are: 1) to attract and retain high quality soldiers and civilians; 2) to maintain forward-looking warfighting doctrine; 3) to maintain force size and mix of heavy, light, and special operations units required by national strategy; 4) to conduct tough, realistic training; 5) to continuously modernize to ensure Army forces have needed warfighting capabilities; and 6) to develop competent, confident leaders. The Army must continually modernize to insure that the forces have needed warfighting capabilities, and we must secure a force that is appropriately equipped in heavy, light, and special operations units that are required by national strategy. It is our responsibility to manage this continuation of the modernization process to meet these goals.

The Army's mission continues to be to deter, and if deterrence fails, to fight and win. The modernization of our equipment over the past decade has significantly enhanced our ability to deter. We have been able to field superior tanks and fighting vehicles, to deploy attack and logistics helicopters that have proven their mettle in Panama, and to field smart munitions capable of giving the artillery pinpoint accuracy. These are just a few of our successes. We must maintain this momentum, albeit at a slower pace, into the 1990's and beyond.

It is our responsibility to the Congress and to the American people to use efficiently the substantial resources provided to continue this modernization effort, so that deterrence is still effective. We are accomplishing this goal through a number of initiatives.

First, we have streamlined the acquisition process through the elimination of layers and restructuring of procurement functions. This effort continues with fine tuning from the recent Defense Management Review. As the Secretary of Defense has discussed, there will be substantial cost-savings resulting from the implementation of this effort.

Second, we are taking steps to assure Congress and the American people that the most is made from the money entrusted to us through rigid adherence to cost, schedule, and performance criteria that are developed for each hardware system. By following these guidelines and making sure milestones are achieved on time and on schedule, we will be certain to procure the best equipment for the resources available.

Third, we have taken a hard look at the weapon systems that the Army currently has, and have chosen to eliminate some, in order to develop fully the potentials of those that we see as having the largest payoff, as in the LHX, armored modernization, and deep attack programs. The light helicopter program will provide a substantial increase in performance through such innovative technologies as the use of composite materials. This increase in performance, cost-saving in operations and maintenance, as well as total flexibility of response in all contingency situations clearly justifies the investment of today's dollars for achieving the superior aircraft in the mid-1990s.

Fourth, we have committed to a strong and focused technology base to provide the bridge to our trained and ready Army of the future. Our technology base investment strategy for achieving these critical warfighting capabilities and avoiding technological surprise is contained in the Army Technology Base Master Plan published last year. We have protected our basic research and exploratory development programs by funding them in this budget for real growth above the FY90 levels. Approximately 25% of our technology base is invested in key emerging technologies in compliance with the DOD Critical Technologies Plan. We have made considerable advances in the Army Domestic Technology Transfer Program, support of dual use technologies and leveraging the technology base programs of other agencies. To reduce the time from concept to fielding of promising technologies, we have instituted Advanced Technology Transition Demonstrations which are closely linked to the Army's resource-constrained force modernization plans. In an age of rising uncertainty due to rapidly changing world events, we must protect this corporate investment in the future Army.

And, lastly, we are proud of our Program Executive Officer (PEO) system. Over the past couple of years it has proven itself in its credibility and in its streamlining and improvement of overall management of the individual weapon systems. Paired with this PEO structure, the Army Materiel Command, the Army Strategic Defense Command, and the Information Systems Command have offered the matrix management support to the PEO system to make it work. The PEOs are the umbrella over the individual Program Managers, and report directly to the Army Acquisition Executive. This allows for streamlined reporting, surfacing problems earlier, obtaining high level involvement, and gaining consensus earlier in the development process, thus saving time, money, resources, and setting the program on the appropriate track to meet the needs of the Army.

The following paragraphs discuss the research, development, and acquisition fiscal year 1991 budget request. They are divided into major mission areas, with the actual dollars presented in the final chapter. In this context, strengths and weaknesses can be measured against operational requirements within each individual mission area. In these days of uncertainty in the world situation it is our responsibility to maintain and equip a modern force in the most cost-effective manner. We believe that the budget we are submitting for fiscal year 1991 achieves this goal.

CLOSE OPERATIONS

Close operations are engagements fought by infantry, armor, aviation, engineer, and field artillery soldiers and other supporting arms at the Forward Line of Troops (FLOT). These are the front line soldiers, and their job is to close with and destroy the enemy by the direct application of combat power. To accomplish their mission, they must be organized into units that are well trained, well led, and that have modern equipment to give them the qualitative edge necessary to fight and win.

The predominant weapons systems of the close battle are the tank, the infantry fighting vehicle, and the attack helicopter. Our forces equipped with these direct fire weapons and organized into combined arms teams are the nucleus of all our modern heavy divisions. The process of modernizing these systems must continue to meet the evolving threat and to leverage technological advances. The following paragraphs address our modernization plans and describe the key close battle systems requested in the FY91 budget.

ARMOR/ANTIARMOR MODERNIZATION PLAN

The Armor/Antiarmor Modernization Plan (A3MP) was approved by the Chief of Staff of the Army in July 1989. This plan provides for continuous modernization of the Army's A3 capabilities and focuses Army A3 modernization as a consequence of development in the threat, advances in our technologies, refinements of force designs and force structure, and available fiscal resources. The plan delineates the Army's A3 modernization efforts in the mid and far term to ensure adequate growth in the light and heavy force A3 warfighting capabilities when compared to expected Soviet improvements.

The A3MP centers on the combined arms and supports both the Airland Battle Doctrine and Airland Battle-Future operational concept. Materiel programs, training strategies, and supporting analyses are incorporated in the A3MP.

ARMORED SYSTEMS MODERNIZATION PLAN

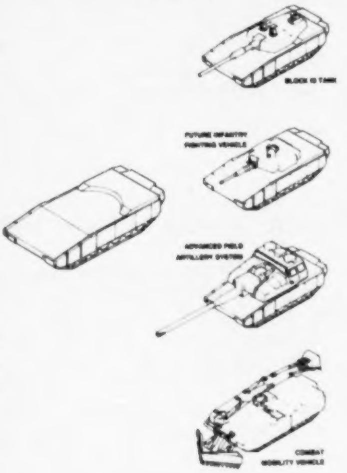
The means to a credible, combat effective conventional land force is a continuous, dynamic modernization process that provides warfighting capabilities to match or exceed the threat, and allows us to take advantage of technological opportunities. The Armored Systems Modernization Plan (ASMP) provides the Army this capability.

The ASMP provides for preplanned product improvements to the current fleet of heavy vehicles in the near and mid term. In the far term, the ASM strategy will modernize the heavy force to maximize operational capabilities and interoperability through procurement of vehicles developed on like or similar medium and heavy chassis. Integration of evolutionary technology into current systems and development of future systems stressing commonality, concurrency in development, a streamlined acquisition strategy, and a realistic fielding plan will permit acquisition of state-of-the-art warfighting systems in the shortest time and at reduced costs.

The seven top priority systems in the ASMP are the Block III Tank, Combat Mobility Vehicle, Advanced Field Artillery System, and Future Infantry Fighting Vehicle on a heavy protection level chassis and the Future Armored Resupply Vehicle - Ammunition and Line-of-Sight Anti-Tank (LOSAT) on a medium protection level chassis, and the Armored Gun System. The first system, LOSAT, is scheduled for fielding in the mid-1990's. The Block III tank will be the lead vehicle on the heavy protection level chassis.

ARMORED SYSTEMS MODERNIZATION

Common Chassis Advanced Technology Transition Demonstrator
CCATTD


BLOCK III TANK
FUTURE INFANTRY FIGHTING VEHICLE
ADVANCED FIELD ARTILLERY SYSTEM
COMBAT MOBILITY VEHICLE

In FY91, a demonstration of the integration of advanced, pacing technologies in a vehicle test bed will be completed, full scale development (FSD) of LOSAT will be performed, and two competitive demonstrations will be conducted to determine the degree to which commonality of components and chassis can be achieved.

M1 ABRAMS TANK

The Abrams is a fast, mobile, turbine-powered main battle tank with unprecedented ballistic protection and an advanced fire control system linked to a stabilized main gun. The Army began production of the basic M1 armed with a 105mm cannon in 1980. In 1986 the Army began fielding the M1A1 (Block I) model with a series of upgrades including a 120mm smoothbore cannon, improved armor protection, and Nuclear, Biological and Chemical (NBC) microclimatic cooling system. Limited production of the follow-on model, M1A2 (Block II), will continue to improve the tank's reliability, lethality, protection, and crew survivability.

Abrams Tank - Cross Country Mobility

On 31 August 1989 the Defense Acquisition Board (DAB) approved all options of the Block II Improvement Program for continued Full Scale Development, and reported a disciplined approach in terms of cost, technology improvements and schedule to meet the threat. It recommended a cost cap for the total tank of $3.037M in FY89 constant dollars as a cost reduction requirement, and approved the distributed data and power architecture, Improved Commander's Weapon Station, and Commander's Independent Thermal Viewer for production. The carbon dioxide (C02) Laser Rangefinder, Survivability Enhancement Packages, and Position Navigation unit require additional cost benefit analysis or may be brought in under the cost cap for the total tank.

In FY91 the Army will procure 225 tanks; 163 will be the M1A1 model, and 62 M1A2s are scheduled for an August 1992 cut-in. The FY91 buy is the last year planned for Abrams tank procurement. FY91 research, development, testing and evaluation (RDT&E) funding focuses on Block II system integration and testing, weight reduction, and M1A2 training device development.

By the end of FY91, U.S. armor units in Europe, prepositioning of materiel configured to unit sets (POMCUS), Korea, and active component (AC) armor units in the continental U.S. (CONUS) will be equipped with the M1A1 or M1A2. Eighteen Reserve Component Roundout and non-Roundout units will also receive the Abrams tank during the same timeframe.

BRADLEY FIGHTING VEHICLE SYSTEM (BFVS)

The Bradley Fighting Vehicle (BFV) is a full tracked, lightly armored vehicle equipped with TOW anti-tank missiles, the 25mm cannon and 7.62mm coaxial machinegun. It is produced in two configurations, the Infantry Fighting Vehicle and the Cavalry Fighting Vehicle. Both vehicles are identical externally, but internally optimized for their operational missions. The BFV has the cross country mobility to operate with the M1 Abrams on the combined arms team. Bradleys allow our mechanized forces to maneuver and fight during day or night combat operations, providing fires while on the move. The Bradley is an essential element of our modernized battlefield capability.

The Bradley with Reactive Armor

FY91 will be the twelfth year of production for the Bradley and the second year of a proposed five year multiyear procurement. The FY91 procurement provides for 600 vehicles. Bradley Fighting Vehicles procured in FY91 are the survivability enhanced M2/M3A2 versions configured with improved armor, spall liners in the troop compartment, and limited fuel and ammunition restowage contract expected to be awarded in the 4th quarter FY90.

As of 31 December 1989, 46 battalion size units have received and fielded the BFV. Seven of these units are Army National Guard battalions. By the end of FY91, the Army expects to have fielded Bradleys to 75 battalion size units, eleven of which will be National Guard battalions.

AVIATION MODERNIZATION PLAN

The Army Aviation Modernization Plan (AAMP) is a summary document updating the objective plan for equipping Army Aviation with a modern, capable, and cost effective warfighting fleet. Since its initial publication in February 1983, the AAMP has been the basis for the Army Aviation aspects of the last six editions of the Department of the Army's Long Range Research, Development, and Acquisition Plan (LRRDAP), as well as the last five Program Objective Memoranda (POM) and associated Extended Planning Annexes (EPA). However, since 1983, there have been significant advances in the sophistication and capabilities of the threat; our technologies have developed rapidly; the Army has refined its force designs and force structure, including Army Aviation; and the overall defense budget has become increasingly constrained. The update reflects the relevant fiscal and program stipulations contained in Congressional and Office of Secretary of Defense (OSD) directions.

In light of the above directions, the 1989 edition of the AAMP includes difficult trade-offs and decisions regarding aviation programs. The AAMP focuses and establishes priorities for the ongoing Aviation modernization programs and defines a strategy that enhances current capability and fulfills future systems and organizational requirements for the total Army's aviation forces.

AH-64A APACHE

The AH-64A Apache is the Army's primary anti-armor attack helicopter. It is a two place, tandem-seat, twin-engine, single four-bladed rotor helicopter capable of employing up to 16 Hellfire missiles or 76 2.75-inch Hydra 70 rockets, along with 1,200 rounds of 30mm cannon ammunition. The weapons suite can be configured for employment depending on mission requirements.

AH-64 APACHE

The AH-64A is a highly mobile weapons system capable of providing direct and indirect aerial fire during day, night, and limited visibility operations. This is accomplished with the Target Acquisition Designation Sight/Pilot Night Vision Sensor (TADS/PNVS). The AH-64A is equipped with a modern suite of avionics and Aircraft Survivability Equipment (ASE). The research and development (R&D) effort for the Longbow (formerly the Airborne Adverse Weather Weapons System (AAWWS)) will continue through FY94 with Low Rate Initial Production (LRIP-Milestone IIIA) decision in the FY93 time period. As of November 1989, 534 Apaches have been delivered and 469 fielded. There are 18 Apache battalions deployed and ready for combat. The program calls for a total of 807 Apaches for a force structure of 40 battalions.

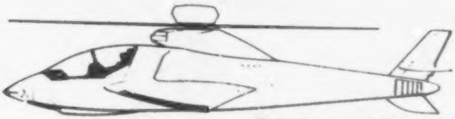
LONGBOW APACHE

LIGHT HELICOPTER PROGRAM (LHX)

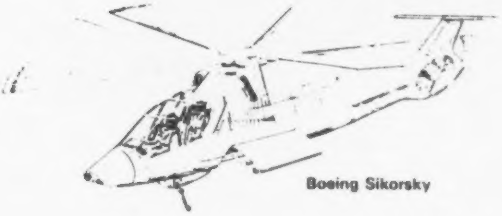
The LHX will replace the AH-1, OH-6, and OH-58 light helicopter fleet and complement the AH-64. The light fleet is approaching obsolescence and will be unable to meet the threat of the mid-1990's and beyond. Missions of the LHX include armed reconnaissance and light attack with an inherent air-to-air capability. The LHX will provide a highly reliable, easily maintained weapon system with the lethality and survivability necessary for deployment on the battlefield of the future. The LHX will have enhanced combat capability through the use of advanced technologies in the Mission Equipment Package (MEP), airframe, and engines. Enhancements in target acquisition, night pilotage, and navigation systems expand the warfighting capability of Army aviation into the hours of darkness and adverse weather.

Demonstration/Validation (DEM/VAL) of LHX, which began in November 1988, will support the December 1990 Full Scale Development (FSD) decision. DEM/VAL objectives are the demonstration of key MEP components, the definition of a common MEP architecture for LHX and future block upgrades to the current production fleet, and the final definition of performance requirements. DEM/VAL and FSD schedules support an initial operational capability for the LHX in December 1996.

LHX will be powered by two 1200 shaft horsepower T800 engines. The T800 is continuing on schedule, on cost, and exceeding performance estimates. The T800 employs advanced engine technology to obtain a high power to weight ratio with low specific fuel consumption. Preliminary flight rating testing was completed in 1989 and engine qualification testing continues. Critical Design Review will be held in March 1990.



Bell McDonnell Douglas



Boeing Sikorsky

LIGHT HELICOPTER PROGRAM CANDIDATES

LHX is a key conventional force initiative that will enhance the conventional warfighting capability of the Army while remaining within constrained force structure and funding projections.

OH-58D KIOWA WARRIOR

Scout helicopters perform the vital reconnaissance mission as well as intelligence, surveillance and target acquisition and designation. The OH-58D Kiowa Warrior, gives the Army the finest scout helicopter in the world. It employs a thermal imaging system, laser rangefinder/ designator and high power television incorporated into a Mast Mounted Sight (MMS) that provides superior threat detectability and aircraft survivability. Operating day or night under hot and adverse weather conditions, the OH-58D provides command and control, target acquisition and target designation. The Army intends to retrofit 243 aircraft to an armed configuration which includes Air-to-Air-Stinger (ATAS) and Air-to-Ground (ATG) weapons. The ATAS will provide a self-defense capability against airborne threats. The ATG weapons will provide defense against ground threats and will service high-priority targets. Included are Hellfire, Hydra 70 rockets, and a .50-caliber machine gun.

KIOWA WARRIOR
IN FLIGHT

HELLFIRE

Hellfire is a third generation airborne antiarmor weapon. It is presently employed as the main armament of the Apache helicopter and planned for the AHIP and LHX helicopters as well. Hellfire homes on a laser spot that can be projected from ground observers, other aircraft, or the launching aircraft itself. This enables it to be employed in a variety of modes, including autonomous, air or ground, direct or indirect, single shot, rapid or ripple fire. It has a longer standoff range and shorter time of flight than the TOW missile system. Hellfire has been in full production and fielded with the Apache since 1986. FY91 funds provide for 3002 missiles. An improved warhead to defeat the near term threat will be cut-in during FY90 production and delivered in FY92. An optimized missile for the long term threat will enter full scale development in the 3rd Qtr FY90 with production cut-in planned for FY92 and deliveries in FY94.

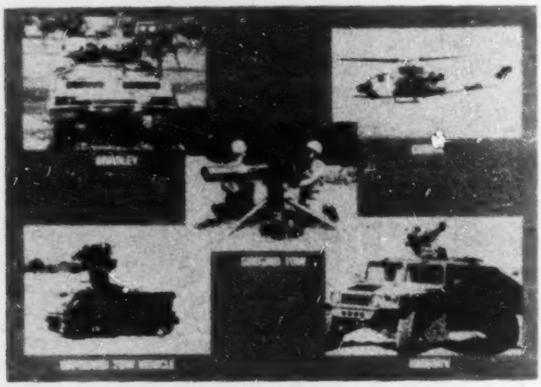
HELLFIRE MISSILE

U.S. ARMY
U.S. ARMY

TOW

TOW, a tube-launched, optically tracked, wire-guided missile, has been the Army's primary heavy antiarmor/assault weapon since 1970. It is found at battalion level in ground units and is also mounted on the Bradley Fighting Vehicle, Improved TOW Vehicle, the High Mobility Multipurpose Wheeled

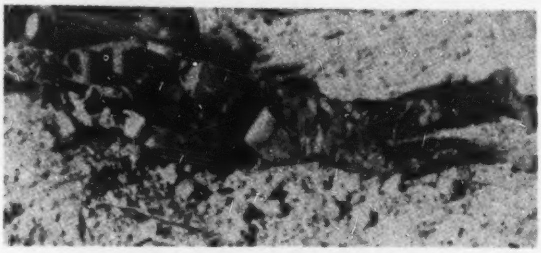
Vehicle (HMMWV) and on the AH-1S Cobra helicopter. TOW has been continually upgraded since its initial fielding. TOW 2 missiles and modification kits have been fielded in all active army commands. Fielding continues with the National Guard and Army Reserve units. An aggressive product improvement program, including the TOW 2B and alternate TOW 2B warhead development efforts and the TOW Sight Improvement Program (TSIP) will significantly enhance the current system's capabilities and ensure TOW weapon system effectiveness into the late 1990s.



TOW CONFIGURATIONS

AAWS-M

The Advanced Antitank Weapon System-Medium (AAWS-M) will be a one-man portable weapon employed at the infantry platoon level to defeat the current and projected armor threat. The AAWS-M will be developed to replace the Dragon, fielded in 1972, addressing its considerable deficiencies. The AAWS-M program will give the infantryman a fire and forget medium antitank weapon system capable of operating effectively in battlefield environments filled with obscurants and electro-optical countermeasures. The missile will be guided to the target by an Imaging Infrared technology currently under development. On 21 June 1989, a joint venture team was awarded a 3-year Full Scale Development contract with options for two years of Low Rate Initial Production. The third year buy will begin Full Scale Production in full competition between the two contractor teams resulting in a split buy. AAWS-M is scheduled for fielding in FY94.



AAWS-M / ONE-MAN PORTABLE WEAPON

AAWS-H

The AAWS-H program will produce a crew served TOW replacement weapon employed by both heavy and light forces to provide stand-off overmatch to defeat the current and projected Soviet armor threat. The different characteristics of the many platforms and systems AAWS-H will displace and their unique missions require that the AAWS-H provide a family of weapons to satisfy the requirements. This potential family of weapon systems consists of the Line-of-Sight (LOSAT) system using a Kinetic Energy Missile System (KEM) and the Advanced Missile System-Heavy (AMS-H). The LOSAT will be developed as a replacement for the Improved TOW Vehicle dedicated antitank system and is a component of the Armored Systems Modernization Plan (ASMP), while the AMS-H will eventually be developed as the replacement for all other systems using the TOW. LOSAT and AMS-H will operate out to the maximum range of direct fire combat engagements, provide increased rate of fire and enhanced performance under day/night, adverse weather, and obscured battlefield conditions. LOSAT is in the Proof of Principle phase, to be completed by 4th Qtr, FY90. In August 1988, the Army leadership approved the decision to accelerate the LOSAT prototype development effort.

AMS-H efforts are geared toward missile guidance improvements for future missiles. A Request for Proposal (RFP) was released in September 1988 for the Imaging Infrared (IIR) seeker Technical Demonstration. Full Scale Development is scheduled for FY91 with competitive selection of a contracting team for AMS-H and LOSAT that will compete in first production beginning in FY94.

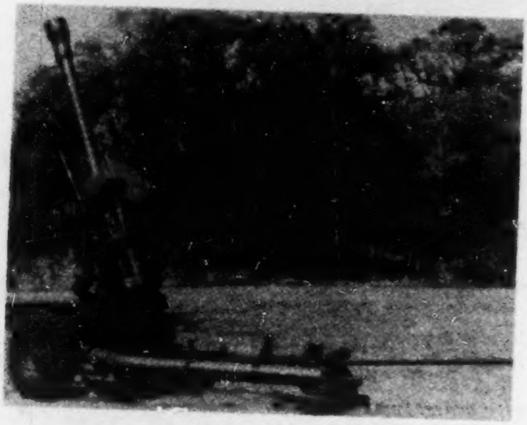
M109A6 155MM HOWITZER IMPROVEMENT PROGRAM

The M109 Howitzer Improvement Program (HIP) will provide the capability of semi-autonomous operations, rapid emplacement and displacement, improved operation in a nuclear, biological and chemical (NBC) environment and improved availability. M109 HIP modifications include: an improved recoil system, gun mount, and cannon assembly; a communications and electronics package; ballistic computer and self-locating positioning/navigation system; micro-cooled vests; improved ballistic protection; built-in test equipment (BITE); and hydraulic and electrical improvements. These improvements, coupled with other improvements previously designed under the Howitzer Extended Life Program (HELP), now incorporated into HIP, result in the M1O9A6 configuration. HIP is a cooperative program with Israel [Israeli research, development, test and evaluation (RDTE) effort of $28M]. FY91 will continue the Low Rate Production (LRP) effort begun in FY90 resulting in an initial procurement of 222 HIP howitzers.

M109A6
155 MM
HOWITZER
IMPROVEMENT
PROGRAM

M119 LIGHTWEIGHT HOWITZER

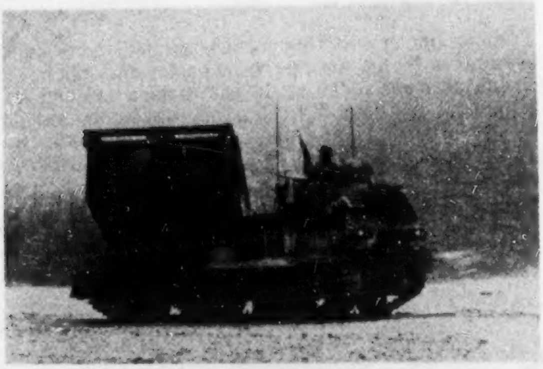
The M119 is a lightweight, towed 105mm howitzer that adds needed firepower and improved range for the Army's rapidly deployable light infantry, airborne and air assault divisions. The M119 will replace existing M102 howitzers currently in light divisions. It is a non-developmental item procurement of the L119 British Light Gun. It can be airmobile when configured with the High Mobility Multipurpose Wheeled Vehicle (HMMWV). Initial fielding was during 1989 to the 7th(L) Infantry Division, Fort Ord, California. During FY90 all production shifted from the UK to the US arsenal system. The first deliveries of U.S. produced howitzers are scheduled for 4th Qtr, FY91. The Army intends to purchase 548 weapons.



M119 LIGHT HOWITZER

MLRS

Multiple Launch Rocket System (MLRS) is a free flight, multiple launch rocket system with a Dual Purpose Improved Conventional Munitions (DPICM) warhead. MLRS supplements cannon artillery fires by delivering large volumes of firepower in a short time against critical, time sensitive targets. The MLRS includes the M270 self-propelled tracked launcher, disposable launch pod containers (LPC), and rockets. The launcher carries two LPCs of six rockets each, a total of 12 rockets per launcher load. The MLRS launcher is dual purpose in that it will fire a whole family of munitions that includes the Army Tactical Missile (both Antipersonnel/Antimateriel and Antiarmor



MULTIPLE LAUNCH ROCKET SYSTEM

submunition), the nuclear Follow-On to Lance, the antiarmor submunition Terminal Guidance Warhead (TGW), the XM135 Binary Chemical Warhead (BCW) and the MLRS-SADARM. The FY91 program continues the second MLRS multiyear procurement (MYP). In FY91 and FY92 the Army will procure 2.5 battalions in each year. European production of MLRS launchers and rockets began in 1989.

M9 ARMORED COMBAT EARTHMOVER

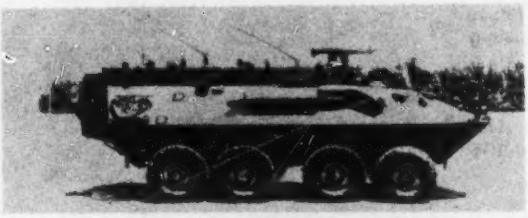
The M9 Armored Combat Earthmover (ACE) is an armored earthmoving vehicle which can keep pace (30 mph) with front line mechanized combat forces. The ACE can dig, doze, haul and scrape to provide mobility, countermobility, and survivability support while providing small arms, artillery fragmentation, and nuclear, biological and chemical (NBC) protection to its

ARMORED COMBAT EARTHMOVER IN ACTION

operator. The ACE has been fielded to one battalion and to the Engineer school since 1986 with low rate initial production vehicles. Initial production testing was completed in August 1988. Fieldings are scheduled to continue to mid 1990. The ACE significantly increases the combat engineer's ability to provide timely combat engineer support to the maneuver forces.

XM93 NUCLEAR, BIOLOGICAL AND CHEMICAL RECONNAISSANCE SYSTEM

The XM93 NBC Reconnaissance System (NBCRS) is ~~a fully~~ integrated NBC detection, warning and communication system which will be used in conjunction with conventional reconnaissance elements. The system will detect, identify, and mark areas of NBC contamination; collect and store soil, water and vegetation samples for later analysis; designate lanes of clear passage for troop movement; and transmit NBC information to area commanders. This is a new concept which does not replace an old system. Basis of issue is 6 per heavy division and armored cavalry regiment; 36 per Corps. The first unit equipped will be in the early 1990's.



LIGHT ARMOR VEHICLE (LAV)

FUCHS

120MM MORTAR

The 120mm mortar is a smoothbore, muzzle-loaded, nondevelopmental weapon system. The system will replace the 4.2 inch mortar used by the Army's heavy divisions since WWII. The 120mm mortar will be employed in towed and carrier-mounted versions. Initial fielding of the towed variant occurs in 1991 to the 9th Infantry Division. The 120mm mortar will enhance growth potential as a result of the larger cartridge, training commonality with the 60mm and 81mm mortars, and improve interoperability with NATO. During FY90, the development of the family of enhanced ammunition consisting of improved high explosive (HE), smoke, and illumination will continue working towards type classification in early FY 91. The FY91 budget request procures 196 120mm mortars.

SMALL ARMS

An area of importance in the close operations is the direct fire of small arms.

The most notable small arms systems currently in procurement include the M9 Personal Defense Weapon, the M16A2 rifle, and the M249 Squad Automatic Weapon (SAW). All of these small arms programs are on multiyear contracts.

The M9 is a 9mm semi-automatic pistol designed to replace the .45 and selected .38 caliber pistols in the DOD inventory. It is capable of firing NATO standard 9mm ammunition. Procurement has been ongoing since 1985 with over 140,000 pistols already delivered. A Congressionally mandated recompetition was conducted from August 1988 through May 1989. The Government's M9 was the decided winner, and, as a result, additional option

M9 9MM SEMI-AUTOMATIC PISTOL

quantities of M9s were awarded to the current contractor. FY91 represents the second option year (if executed) of the continuing procurement.

M16 A2 RIFLE

The M16A2 is an improved version of the M16A1 and is being issued as the Army's primary combat rifle. It is a lightweight, air-cooled, gas-operated, low impulse rifle firing from either twenty or thirty round magazines. It incorporates improvements in sight, pistol grip, stock, and overall combat effectiveness. It is capable of firing the heavier NATO standard 5.56mm ammunition. To date, over 262,000 weapons have been fielded. A multiyear contract has also been awarded for modification kits to allow the Army to convert M16A1s to A2 configuration during depot overhaul. FY91 represents the fourth year of a five-year multiyear procurement.

SQUAD AUTOMATIC WEAPON

The Squad Automatic Weapon (SAW) is a lightweight, one-man-portable machine gun designed to replace the two M16A1 Automatic Rifles in each infantry squad (on a one-for-one basis). Like the M16A2, the SAW is a 5.56mm weapon and fires the NATO standard ammunition. It is capable of a cyclic rate of fire of 750 rounds per minute with a maximum effective range of 800 meters. Improvements recommended by users have been successfully tested, approved, and incorporated into the current multiyear contract. To date, 8,179 weapons have been delivered to the Army and fielding has occurred both in the Continental U.S. and Outside Continental U.S. FY91 represents the fifth year of a five-year multiyear procurement.

AMMUNITION MODERNIZATION

A vital part of overall Army modernization is the improvement of ammunition on all parts of the battlefield. The Army plans to field several new munitions to improve the range and lethality of existing weapon systems. The new ammunition to be fielded in FY91 is 120mm and 105mm Kinetic Energy Tank Rounds, 105mm High Explosive Rocket Assisted Artillery Round, and 25mm Armor Piercing Fin Stabilized Discarding Sabot-Tracer Round.

Fielding this ammunition will greatly improve Army combat power. For example, the 105mm Kinetic Energy Tank Round will improve to a great extent the armor-killing ability of the 105mm M1 series of tanks. Also the 105mm High Explosive Rocket Assisted Artillery Round will increase the range and lethality of light force artillery support. The 25mm Armor Piercing Fin

Stabilized Discarding Sabot-Tracer Round will enhance the armament of the Bradley Fighting Vehicle. The Army must maintain a strong research and development (R&D) effort to enable the force to defeat advanced threat armor being introduced into the battlefield. Efforts must continue on the Armor Enhancement Initiative (AEI) where previous R&D efforts are now paying big dividends. A strong R&D effort is also required to improve mine warfare capabilities. For example, continued fielding of VOLCANO and the development of the Wide Area Mine (WAM) is essential to defeat advanced threat armor. The Army has no choice but to consolidate its aging ammunition base in order to ensure ammunition funding procures ammunition instead of maintenance of unneeded ammunition plants.

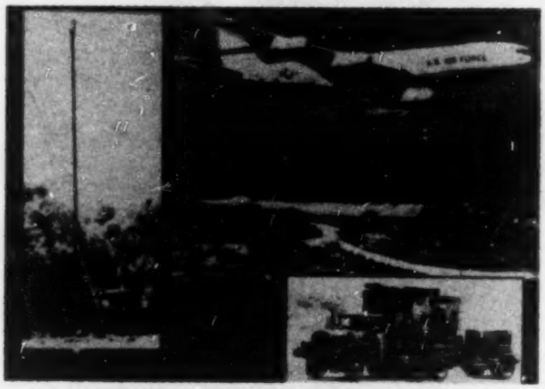
DEEP OPERATIONS

Deep Operations allow us to win Close Operations by shaping the conditions of the battlefield. The activities typical of deep operations include the surveillance and acquisition of enemy targets, the disruption and destruction of these targets through deep fires and/or maneuver, deception of the enemy, actions to counter the command and control systems of the enemy, and command and control of our own forces. These combined efforts prevent successive echelons of enemy forces from overwhelming our units in close operations.

Currently our forces do not have the full capabilities necessary to execute deep operations to the extent envisioned by AirLand Battle doctrine. Joint programs with the Air Force provide for the majority of the deep operations requirements, but we are also developing capabilities on our own to better execute deep operations, as discussed in the following paragraphs.

Joint STARS

To enable force commanders to extend their target attack capability to more than 100 kilometers deep into the enemy's force array, the Army and Air Force are developing the Joint Surveillance and Target Attack Radar System (Joint STARS). Joint STARS is a battle management and target attack control system that will detect, track and assist in attacking moving and fixed tank-



Joint STARS COMPONENTS

sized targets. The Army is specifically developing the Ground Station Module (GSM) for tactical receipt, processing and dissemination of Joint STARS data while the Air Force is developing the airborne platform, radar and data links.

Radar data will be transmitted through the secure data link mounted on the E8 (militarized Boeing 707) airframe to multiple GSMs. The GSM will process, display, evaluate and transmit tactically derived information from airborne radars into Army Command, Control, Communications and Intelligence (C3i) nodes at corps and division headquarters and artillery Multiple Launch Rocket System (MLRS) and Army Tactical Missile System (ATACMS) battalion headquarters. Joint STARS will also share information with other intelligence and fire support systems.

Joint STARS targeting information is transmitted from the GSM to the Tactical Fire Direction System (TACFIRE/ Advanced Field Artillery Tactical Data System) while situation development information will be transmitted to the All Source Analysis System (ASAS).

Various configurations of the GSM are planned to satisfy both short and long term requirements. Nine Limited Procurement - Urgent GSMs are being fielded in FY90 to Military Intelligence Battalions in order to receive, process and evaluate Side Looking Airborne Radar (SLAR) data. When the Joint STARS airborne platform is initially fielded, the Army will field five Interim and six Block I GSMs. This fielding will be followed by the fielding of the Block II GSM which will meet all user requirements to include nuclear, thermal, and blast protection.

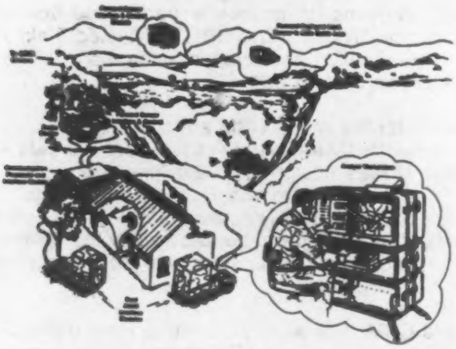
Currently one GSM has been delivered to France and one to the United Kingdom for participation in the NATO Airborne Radar Demonstration System (ARDS).

ALL SOURCE ANALYSIS SYSTEM

All Source Analysis System (ASAS) is the central nervous system for commanders to successfully execute AirLand Battle/Deep Attack. As a key tactical sub-element of the Army Tactical Command and Control System (ATCCS), ASAS will automate command and control of Intelligence/Electronic Warfare (IEW) operations. ASAS generates a near-real-time picture of the enemy situation to guide employment of maneuver forces and combat support systems such as Joint STARS and the Army Tactical Missile System (ATACMS). ASAS automation will improve the capability to process and respond to information collected by sophisticated sensor systems and will use state-of-the-art minicomputers to improve speed and accuracy. The Joint Tactical Fusion Program Office is developing ASAS in parallel with the Air Force Enemy Situation Correlation Element (ENSCE).

ASAS/ENSCE employs an evolutionary acquisition strategy. The architecture is modular in nature with three major hardware components. They are the Forward Sensor Interface and Control (FSIC) module which relays data from ground base sensors/sources in forward combat areas back to data processing modules and provides interface between data processing modules and the area communications network; the ASAS/ENSCE Interface Module (AIM), or Dual AIM (DAIM), which processes intelligence data; and the Portable ASA/ENSCE Workstation (PAWS), which is the primary user interface with the system.

ALL SOURCE ANALYSIS SYSTEM

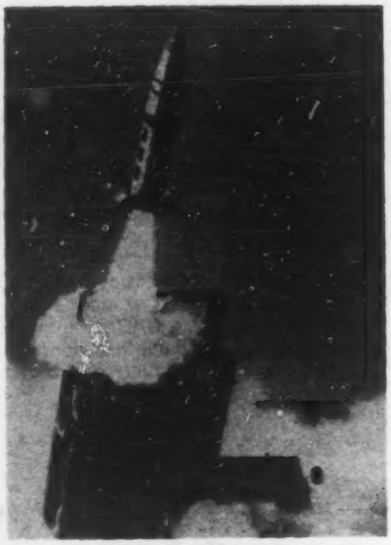


Field trials of the FSIC and AIM were conducted in December 1986. A Limited Capability Configuration (LCC) comprised of FSIC, AIM and PAWS was delivered to III Corps, Fort Hood, TX in March 1989. Training commenced at Fort Hood in June 1989 in preparation for the Force Development Test and Experimentation (FDT&E) which took place in December 1989. The Initial Operational Test and Evaluation (IOT&E) will be completed in FY91 and Milestone III Decision (production) in 3rd Qtr FY92.

Contract award for LCC-Europe (LCC-E) is planned for 2nd Qtr FY90. LCC-E will consist of 2 Corps sets and 4 Division sets. The objective system will evolve through pre-planned product improvements and software refinements based on user feedback.

ATACMS

Army Tactical Missile System (ATACMS) is an improved conventional semi-ballistic missile system designed to destroy, neutralize, disrupt, or delay enemy second echelon forces and other targets of importance to the Corps at ranges beyond the capabilities of cannon and rockets. This missile will be transported on and launched from the Multiple Launch Rocket System (MLRS) launcher. Each MLRS launcher can carry two Army TACMS missiles, each with 1000 Antipersonnel/ Antimateriel (APAM) bomblets. Army TACMS will be handled as another round of munitions by the existing MLRS force structure and requires no cost in terms of additional manpower or equipment to the firing units. Development Testing began in FY89 and continued through 1st Qtr FY90. Operational Testing begins in the 2nd Qtr FY90 and will be completed in the 3rd Qtr. Low Rate Initial Production began in FY89 and continues through FY90. A production decision is expected in the 4th Qtr of FY90 with FY91 being the first year of Full Rate Production.



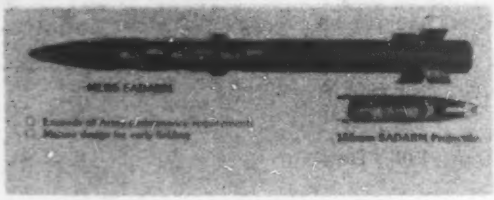
MLRS-TGW

The development of a Deep Attack Antiarmor capability is contingent upon the successful development of a smart submunition. The U.S. is currently involved in a multinational development of a Millimeter Wave Terminal Guidance Warhead (TGW) Rocket for MLRS. Each MLRS-TGW rocket will carry three Terminally Guided Submunitions (TGSM). The MLRS

M270 launcher carries two Launch Pod Containers with six rockets each: a total of 12 rockets containing 36 TGSMs. Each TGSM is capable of locating, attacking and destroying a threat armor vehicle using its Millimeter Wave (MW) seeker and tandem shaped charge warhead. This joint venture with our European partners will help meet an urgent need to defeat hard targets such as moving and stationary armored vehicles before they are committed into the close battle. The TGW program begins Full Scale Development in FY92. MLRS-TGW will continue system demonstration substage research and development in FY91.

SENSE AND DESTROY ARMOR

Sense and Destroy Armor (SADARM) is a fire-and-forget, sensor-fuzed submunition. It is delivered to the target area by 155mm artillery projectiles or by the MLRS. The submunition is dispensed from its carrier over the target area and detects appropriate targets using dual-mode millimeter wave and infrared sensors. After detection, SADARM fires an explosively formed penetrator to defeat the target through the top. SADARM provides enhanced counterbattery support against lightly armored vehicles well beyond the forward line of troops. SADARM enables rapid engagement under inclement weather, degraded battlefield conditions and Nuclear, Biological, Chemical (NBC) environments, both day and night. FY91 continues the full scale development effort.



FOTL

Follow-On to Lance (FOTL) replaces the Lance nuclear missile system. It is essential that the Corps and Theater Commanders have the capability to attack high priority moving and point targets with nuclear fires. FOTL will provide that capability. FOTL is a nuclear missile capable of being fired from a MLRS M270 launcher thus saving force structure and increasing battlefield survivability. Research, Development, Test and Evaluation funds in FY91 and FY92 will initiate Full Scale Engineering Development (FSED) with production planned for FY93.

SPECIAL OPERATIONS AIRCRAFT

The Special Operations Aircraft (SOA) Program will develop and procure sophisticated helicopters capable of deep penetration missions (infiltrating and extracting special forces at low altitudes over unfamiliar mountainous terrain, at night, and in adverse weather). Phase I of the program consists of the development of one prototype and 16 production MH-47Es, as well as one prototype and 22 production MH-60Ks. Phase II consists of the procurement of an additional 34 MH-47Es. To ensure that SOA pilots maintain the highest level of technical and tactical proficiency, a combat mission simulator for each type of aircraft will also be developed.

MH-47E

MH-60K

Significant features of both aircraft are: a fully integrated cockpit common to each aircraft, up-rated engines, forward looking infrared (FLIR) sensors, terrain following/ terrain avoidance (TF/TA) radar, and extended range fuel capacity (internal/external and air-to-air refueling capability).

In FY90, 7 MH-47Es and the first 11 MH-60Ks begin the modification process. The long lead time items for the 34 MH-47Es of Phase II will also be procured. FY91 funds will be used to modify 6 MH-60Ks and 2 MH-47Es. FY92 funds will be used to complete the buy of MH-47's and MH-60's.

IEW

Intelligence and Electronic Warfare (IEW) assets are responsible for providing the maneuver force commander with information regarding the enemy's intentions, locations and activities. This information is essential to allowing the maneuver force commander to properly allocate his combat power to destroy first echelon forces, interdict second echelon forces and disrupt command and control nodes through lethal and nonlethal attack, thus allowing him to assume the initiative.

The IEW assets that perform this vital mission include a variety of ground based and airborne signal exploitation and jamming systems. Guardrail, Quicklook, and Quick Fix provide the commander information of the enemy's deep and mid-range forces while ground based assets such as TACJAM provide close in support. Grisly Hunter is an aircraft equipped for low intensity environments. IEW sensor development in the mid to late 90's will stress open architecture systems where common modules can be shared between air and ground systems, improving interoperability and saving developmental costs.

QUICK FIX

Quick Fix (EH-60A) is a modified UH-60A helicopter equipped with special avionics and IEW equipment to intercept and locate tactical communication transmitters, and to deny their effective use through jamming of selected radio frequencies. The first unit equipped date for the Quick Fix was February 1988. Since then, a total of 66 systems have been accepted by the government. Final units are to be fielded in May 1990. Quick Fix provides

EH-60A QUICK FIX

the Military Intelligence commander with a dynamic and deep looking platform capable of interoperating with the ground based Trailblazer system. The Division Level Common Sensor is the evolution of the Fielded Trailblazer, Teammate, and Quick Fix intelligence and electronic warfare assets designed to keep pace with the expanding frequency agile threat. The Trailblazer will evolve to the Ground Base Common Sensor-Light in support of the Army's Light Division. Development of the Advanced Quick Fix begins in FY92 and production in FY95. These sensors will expand their current interoperability and will use common mission components matching the threat. The Division Level Common Sensor System will be a multidisciplined system initially providing communications and electronic intelligence, electronic countermeasures and targeting data.

GUARDRAIL

The Guardrail Family of Sensors is a combination of fixed wing airborne sensors and a ground processing facility which provide time sensitive critical intelligence on enemy locations and disposition to combat commanders at Corps and below and echelons above Corps. The Guardrail Common Sensor system combines communications and electronic intelligence sensors and adds a precision location capability that is capable of providing targeting information on enemy critical nodes. This system will enter the inventory in 1991. Future plans call for replacing all Guardrail V and Improved Guardrail Vs with the Guardrail Common Sensor configuration. The RV-ID fleet will be retired as the Guardrail Common Sensor is fielded. The first unit set will be retired in FY91, and the retirement will be completed by FY97. Due to the retirement schedule, no RV-IDs will be inducted into the Programmed Aircraft Restoration and Service Life Extension Program.

GRISLY HUNTER

Grisly Hunter is an aircraft equipped with selected sensors to detect, locate, recognize and/or identify land and water based targets. Primary sensors on board the aircraft are an infrared linescanner (IRLS), a forward looking infrared (FLIR) system, and a day imaging system. The system is designed to operate in low intensity conflict environments, with emphasis on the detection, location, recognition, and/or identification of personnel and larger ground targets plus small vessels operating in protected waters. On 1 December 1989, the Grisly Hunter demonstration Aircraft, CASA 212, crashed enroute to Patuxant River NAS where it was to conduct some calibration test flights. The Army plans to maintain its previously planned development schedule. FY91 funds will be used to procure additional aircraft and mission equipment.

TACJAM

TACJAM, AN/MLQ-34, is a tactical ground based communications denial, deception, and disruption system. The Army is in the latter stages of fielding TACJAM. TACJAM-A was conceived as a product improvement to expand the frequency range into the high frequency (HF) range, provide for a capability to intercept, process, and jam emerging signal types, and increase signal handling capacity. As the TACJAM-A program entered full scale development (FSD), it was combined with the Army's Teammate low probability of intercept (LPI) program, a part of the Tactical Cryptologic Program, and was developing an intercept, processing, and direction finding subsystem to be used against emerging signals types. FY91 funds will be used to upgrade mission capability in accordance with the threat.

REAR OPERATIONS

Rear operations are designed to assure freedom of maneuver and continuity of operations for all activities rearward of elements in contact. Rear operations normally include assembly, movement, and positioning of reserves and long range fire support; movement, stockpiling, and distribution of war materiel; maintenance and field services; maintenance of lines of communication; and defense against air, ground, and missile attack. At the operational level, rear operations focus on preparing for the next phase of the campaign.

Our modernization of systems needed to conduct these rear operations is progressing well. The highlights of these systems follow. Under normal conditions, these systems are usually based in the rear area but battlefield requirements often demand that many of them operate in close and deep operational areas. For example, utility transport systems such as the Black Hawk, the Chinook, and tactical wheeled transporters all enter the close operations area to deliver the supplies and personnel required to sustain these operations.

TWVMP

The Tactical Wheeled Vehicle Modernization Plan (TWVMP) provides an objective plan for equipping the total Army with a capable, cost-effective and stable wheeled vehicle fleet through the year 2020. The goals of the TWVMP are to: (1) Fill Army Tactical Wheeled Vehicle (TWV) requirements with a capable, supportable, modernized fleet; (2) Minimize cost of ownership through a program of procurement and service life extension programs (SLEP); (3) Establish acquisition strategies for new procurements which minimize turbulence in the manufacturing base; (4) Establish a TWV useful life program as the baseline for making vehicle retirement and SLEP decisions. The plan establishes prioritized acquisition strategies for the Total Army which are executable within programmed resources, integrated distribution and redistribution strategies, and a detailed TWV program concept. The TWVMP was completed and approved by the Chief of Staff of the Army in April 1989.

The Army continues to upgrade its tactical wheeled fleet to provide better supply support, improve unit mobility, enhance heavy lift for ammunition and fuel, and furnish a more capable heavy equipment transport. The Army will lay the foundations in FY91 for the continued improvement of all components of its tactical wheeled vehicle fleet with strong emphasis on nondevelopmental item (NDI) programs (FMTV, PLS, HMMWV).

HMMWV

The light fleet will be strengthened by a new competitive multiyear contract for approximately 33,000 High Mobility Multipurpose Wheeled Vehicles (HMMWVs) which was awarded in August 1989; this will bring the fleet total to approximately 84,000 trucks. FY91 is the third year of this multiyear contract. The HMMWV has been an important addition to our light fleet in the active force, the Army National Guard (ARNG) and U.S. Army Reserve (USAR). It is a highly mobile, diesel powered, 4-wheel drive tactical vehicle that may be configured as a cargo troop carrier, armament carrier, ambulance, cargo carrier, and shelter carrier. It also serves as a platform for the TOW anti-tank weapons carrier, and Pedestal Mounted Stinger and supports Standard Integrated Command Post Shelter (SICPS) and MLRS (Multiple Launch Rocket System).

HIGH MOBILITY MULTIPURPOSE WHEELED VEHICLE WITH TOW

SUSV

Procurement of the Small Unit Support Vehicle (SUSV) supports the 6th Infantry Division (Light) in Alaska and National Guard (NG) units. SUSV is a tracked vehicle capable of traversing snow and tundra, regardless of depth, in

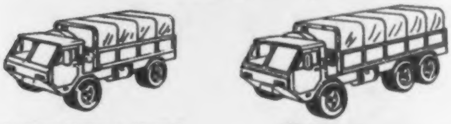
SUSV

all seasons. It is used to conduct operations in northern and mountainous regions and can carry subsistence equipment, ammunition, and supplies required by small units. It can transport a 3,000 lb. (4,400 lb. flatbed) payload and tow a trailer or light howitzer. SUSV is a non-development item and has four variants: cargo, ambulance, flatbed, and command and control. FY91 will be the last year of procurement of the SUSV, which will bring the fleet total to approximately 1,100 vehicles.

FMTV

Our medium vehicle fleet, which is the Army's workhorse for our tactical mobility mission, will continue to endure vehicle shortages, particularly in the 5-ton class, hence the emergence and success of the Family of Medium

FAMILY OF MEDIUM TACTICAL VEHICLES (FMTV)



LIGHT MEDIUM TACTICAL VEHICLE (LMTV)

MEDIUM TACTICAL VEHICLE (MTV)

Tactical Vehicles (FMTV) becomes even more critical to our effort to improve the medium vehicle fleet. The competitive Research, Development, Test and Evaluation (RDT&E) phase of the FMTV program continues through FY91. Production award for FMTV will be in FY91 which will provide an improved medium truck family using current automotive technology to replace aging 21/2 ton trucks and help alleviate the critical shortage of 5 ton trucks. The FMTV will operate on primary and secondary roads, trails, and cross-country terrain in all types of weather.

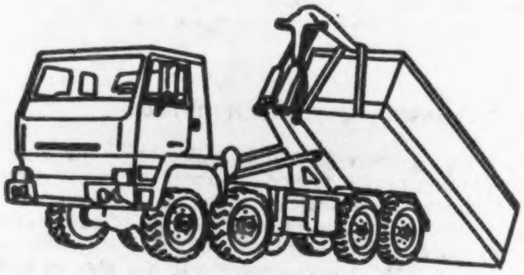
HEMTT

During FY90 and FY91, the Army will procure additional Heavy Expanded Mobility Tactical Truck (HEMTT) vehicles for the Army National Guard and Army Reserve. Including foreign military sales cases, HEMTT should be in production through FY91.

HEMTT

PLS

The Palletized Load System (PLS), a 16.5 ton truck and 16.5 ton companion trailer with self load-unload capability, will be a key transportation component of the total distribution of supplies and equipment. Currently in the prototype development phase, the system begins production in FY90. Fielding



PLS PROTOTYPE DRAWING

of PLS will provide great increases in ammunition distribution efficiency at the Corps level as well as support NATO interoperability.

HETS

A critical addition to the heavy fleet is the Heavy Equipment Transporter System (HETS) which will provide the ability to support, deploy and evacuate the M1 Series Main Battle tank. The tank overloads the older tractor-trailer system. The Army will take initial delivery of the HETS semitrailer in late 1990. The Army recently awarded a contract for the HETS tractor to the Oshkosh Truck Company. Deliveries begin in early FY92.

TRAILERS

Another important mobility element not usually discussed is the procurement of trailers and dolly sets. The Army procures trailers as mission capability extenders for cargo trucks, semitrailers for line haul tractors, and specialized mission tailored trailers in support of other systems (i.e., PATRIOT Launcher-Erectors, FIREFINDER radar set trailers, APACHE electronics trailers). The FY91 trailer line includes $24.7M, which funds ongoing multi-year contracts for trailers and dolly sets. Trailers currently being acquired, tested, and fielded include:

M1061A1	5 Ton Trailer
XM1073	7 1/2 Ton Powerpack Trailer
M1022	7 1/2 Ton ISO Mobilizer Dolly set
M822E1	Semitrailer Van
M871A2	22.5 Ton Line Haul Semitrailer
M860A1	PATRIOT Launcher Semitrailer
M989A1	10 Ton Ammunition Trailer
M1062	7500 Gallon Fuel Tanker Semitrailer

In addition, dedicated systems trailers such as the PLS, FMTV, and HETS are purchased under the FY91 prime mover line.

BLACK HAWK HELICOPTER (UH-60)

The Army's primary tactical lift helicopter is the Black Hawk, with the missions of troop assault, resupply of troops in combat, command and control (C2) and aeromedical evacuation. It can move a squad of 11 troops or 8000 pounds of cargo internally or externally, in all geographical locations. Its enhanced survivability plus technological reliability, availability and maintainability (RAM) improvements give it a staying power never before achieved in a helicopter. More than 1000 Black Hawk aircraft have been delivered to the Army worldwide. A more powerful engine has been added, giving the Black Hawk increased performance.

BLACK HAWK HELICOPTER

CHINOOK HELICOPTER (CH-47D)

The "D" model improvements being incorporated into the Chinook, our only medium lift helicopter, will extend the service life of the fleet beyond the year 2000. Configured to move both internal and external cargoes, the CH-47D allows for the rapid delivery of troops and equipment.

The Chinook has achieved a mission availability rate which is five percent above the Army's standard. The planned production has been increased from 436 to 472 aircraft. FY89 completed the multiyear contract. A second multiyear contract (FY90-92) has been signed to complete the modernization effort for the CH-47 fleet.

DEFENSE FROM AIR ATTACKS

The Army's Air Defense system must protect all Army elements: troop formations, depots, lines of communication, air bases, key command and control facilities, and other vital assets, from the air threat. This mission requires a comprehensive air defense system to defeat the growing air threat at all ranges and altitudes for mature theater and contingency operations, leaving the enemy no preferred attack option.

AD MOD PLAN

The Air Defense Modernization Plan (AD MOD Plan) encompasses the entire air defense mission area: Forward Area Air Defense, Corps Area Air Defense, and Theater Area Air Defense to include Tactical Missile Defense. It provides the framework for modernizing Air Defense Artillery to counter qualitative and quantitative advances in threat air platforms (manned and unmanned, air breathing and ballistic).

The AD MOD Plan provides a constrained, prioritized road map to meet the counter-air requirements of AirLand Battle. Its emphasis is on Pre-Planned Product Improvements (P3I) and non-developmental items (NDI) acquisition rather than new developments. Implementing the AD MOD Plan ensures commander's freedom (from the air threat) to maneuver and mass, and assures commander's endurance by protecting critical command and control (C2), fire support and sustainment elements on the AirLand Battlefield.

FAAD

Given the improvements in threat helicopters and long range munitions, forward area air defense modernization is essential. The Forward Area Air Defense (FAAD) System, a system of systems, was initially defined by a special study group after the DIVAD Gun experience proved that one system alone, or even multiple weapons acting independently, cannot defeat the evolving air threat. The FAAD System is comprised of five different elements: Line of Sight-Forward-Heavy, Line of Sight-Rear, Non-Line of Sight, FAAD C2I (Discussed in the Battlefield Synchronization Section) and Combined Arms Initiative. Each of these elements brings an improved capability in air defense to the battlefield by itself, but combined creates a synergism to further increase air defense effectiveness.

LOS-F-H

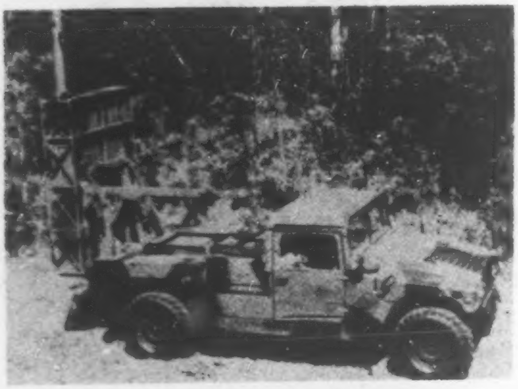
Line of Sight-Forward-Heavy (LOS-F-H) maneuvers with the Combined Arms Team to defeat the fixed wing air threat and provides long range anti-helicopter fires. After extensive testing of NDI systems, Air Defense Anti-tank

LOS-F-H/ADATS

System (ADATS) was selected for the LOS-F-H role. Low rate initial production, 4 fire units and 48 missiles for Production Qualification Testing, began in FY89. Force Development Testing and Experimentation (FDTE) II tests in 1st Qtr FY90 and Initial Operational Test and Evaluation (IOT&E) firings in February 1990 proved that ADATS is a first rate air defense system. Low rate production continues in FY90 with 9 fire units and 110 missiles following operational testing and a Milestone IIIA decision review. Full rate production begins in FY91 following completion of Live Fire Tests with 13 fire units and 220 missiles.

NLOS

Non Line of Sight (NLOS), or the Fiber Optic Guided-Missile (FOG-M) is a long range anti-helicopter and anti-tank system that can defeat targets masked by terrain and beyond the range of line of sight systems. The 43 month Full Scale Development effort began in FY89. The Initial Operational Evaluation and Extended User Evaluation, conducted in FY89 and FY90, have reduced development risks and affirmed the wisdom of Congressional guidance to proceed directly to the objective system. Affordability tradeoffs and reductions in concurrency caused system procurement funds to be deferred.



NLOS/FOG-M

LOS-R

Line of Sight-Rear (LOS-R), (Avenger) counters the predominantly fixed wing air threat to brigade and division rear areas. An exemplary model for NDI procurement, Avenger integrates the combat proven Stinger missile and a .50 caliber machine gun on a HMMWV to provide highly mobile, soldier friendly line-of-sight system operated by a two-man crew. The gyro stabilized turret includes a Forward Looking Infra-Red (FLIR) sensor, Laser Range Finder (LRF), heads-up optical sight and digital fire control computer which improve reaction time and provide day/night and shoot-on-the-move capability. First Unit Equipped, a platoon in the 3rd Armored Cavalry Regiment, occurred in

AVENGER

April 1989, only 20 months after Avenger's selection. Full Scale Production begins in FY90 with 122 fire units. In FY91 the Army requests authority to start a five year multi-year procurement .

CAI

Combined Arms Initiatives (CAI) provide ground and aerial combat elements an enhanced capability for self defense against enemy helicopters. CAI includes: Air-to-Air Stinger (ATAS) on OH-58 and AH-64 helicopters, an Air Defense Sight applique on the Bradley Fighting Vehicle, and development of 360 degree fuzing capability for 120mm tank rounds under the Army's Ammunition Enhancement Initiative.

STINGER

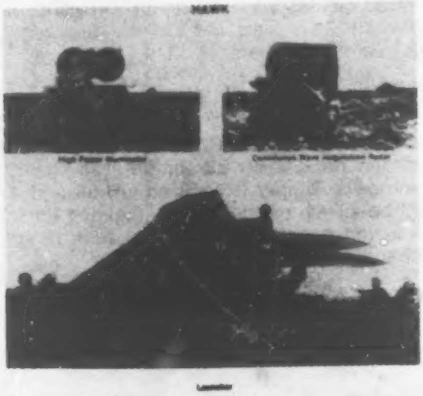
Stinger-Reprogrammable Microprocessor (RMP) continues production in FY91. The third generation of the combat proven Stinger uses a passive infrared (IR) and ultraviolet (UV) homing seeker to guide on the target despite enemy countermeasures. Stinger-RMP placed all key missile guidance functions under software control which allows the missile to be modified by software changes in an external module, rather than making expensive hardware changes to overcome future threats. Initial deployment of Stinger-RMP began in FY90. Applications include the Avenger, Air-to-Air Stinger, and

Man Portable Air Defense Systems (MANPADS). The FY91 procurement request is for 6922 missiles.

STINGER

HAWK

Hawk is a mobile, all weather, missile system which provides vital, low to medium altitude air defense of critical installations and maneuver forces. The venerable Hawk system has been kept current with the threat by timely insertion of new technologies. Hawk battalions have been reorganized into more streamlined and efficient fighting organizations. Key to this reorganization to meet Corps commander's air defense needs is the

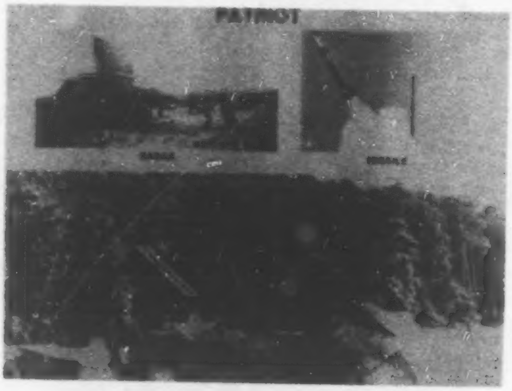

HAWK
High Power Illuminator
Continuous Wave Acquisition Radar
Launcher

continued procurement in FY91 of Phase III Mod kits and continuation of mobility enhancement developments. These improvements will keep Hawk viable through the year 2005 as the Army develops the follow-on Corps Surface to Air Missile (SAM) system

Theater Air Defense forces are composed of Patriot and Hawk integrated with NATO air defenses and Chaparral deployed as point air defense at key U.S. Air Force Bases. In addition to its first rate capability against air breathing threats, Patriot provides the only deployed Tactical Ballistic Missile (TBM) killer in the free world.

PATRIOT

Patriot is an advanced, long range, high to medium altitude air defense system which counters the evolving and extensive fixed wing threat to special theater assets, prepositioned materiel configured to unit sets (POMCUS), and essential, reinforcing lines of communications. Patriot's fast reaction time and multiple engagement capability in severe Electronic Countermeasure (ECM) environments deny the threat saturation attack options. Patriot Anti-Tactical Missile (ATM) Capability (PAC-1), which has been deployed, ensures that Patriot can continue the fight in the face of TBM threats. First fielded in 1986, ten Patriot battalions are now operationally deployed. FY90 procurement completed the Army's buy of Patriot ground support equipment (GSE) and missiles. The FY91 budget request provides for completion of PAC-2 development to attain a limited asset defense against TBMs. It also procures 817 missiles with PAC-2 modifications and GSE for the Italian/U.S. Patriot Memorandum of Understanding (MOU).



JOINT TACTICAL MISSILE DEFENSE

The Joint Tactical Missile Defense (JTMD) is designed to counter the conventional short range tactical missile (TM) threat in mature and contingency theaters. JTMD consists of four components: Active Defense to destroy TMs in flight; Attack Operations to destroy launchers and associated equipment on the ground; Passive Measures to reduce vulnerability to enemy attack; and Command, Control, Communications and Intelligence (C3I) to coordinate JTMD operations.

The Army's response to anti-tactical missile (ATM) requirements is Patriot ATM Capability (PAC). PAC-1 consists solely of software upgrades to Patriot and was fielded in July 1988. Development of PAC-2, Patriot warhead and fuze modifications, will be completed in FY91. The Army will continue its Multi-Mode Seeker program in cooperation with the Federal Republic of Germany under the Nunn initiative. The Multi-Mode Seeker will increase Patriot's Anti-Tactical Missile Defense (ATMD) capability beyond that of PAC-2. In addition, the Army is evaluating Strategic Defense Initiative Office (SDIO) technology for integration as an adjunct to Patriot to achieve an area capability for defense.

In summary, FY91 is an important year for the Army's Air Defense Modernization Plan. It is the first step by which warfighting capabilities in mature and contingency theaters are significantly improved through: the fielding and product improvement of the FAAD system; the formation of Corps Air Defense brigades with a mix of low and medium altitude, strategically mobile air defense weapons; and the development and fielding of capable Tactical Missile Defense capabilities to complement Patriot PAC-2 in theater air defense forces.

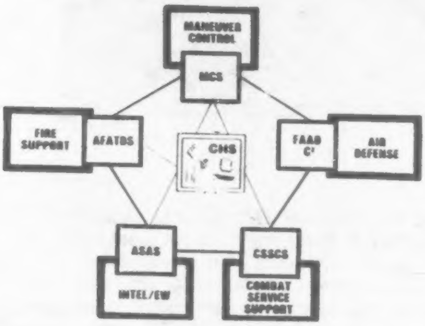
BATTLEFIELD SYNCHRONIZATION

A flexible, integrated and automated command and control (C2) network is needed to provide the battlefield commander with timely information to fight the AirLand Battle. Our C2 mission area has the challenge of keeping pace with the Army's greatly increasing requirement for providing timely information transfer. In all of the five battlefield functional areas - maneuver control, fire support, air defense, intelligence/ electronic warfare, and combat service support - information processing and data transfer are currently limited by manual and partially automated methods. For example, advanced weapon systems have long been in development to support the deep battle concept of the AirLand Battle Doctrine without corresponding C2 upgrades. We are beginning to close the gap.

ATCCS

C2 support responds to five critical requirements: to rapidly collect and assess intelligence; to tightly control battlefield sensors; to engage specific targets; to support maneuver effectively; and finally, to achieve close coordination of battlefield air interdiction and close air support. The C2 network designed to meet these five requirements is the Army Tactical Command and Control System (ATCCS). As ATCCS has evolved, we have for the first time been able to identify and articulate requirements for a common base of hardware and operating system software to support C2 automation. This has been accomplished for all the tactical C2 battlefield requirements serviced by ATCCS as shown in the Sigma Star depiction of the five battlefield functional areas.

ARMY TACTICAL COMMAND AND CONTROL SYSTEM (ATCCS)



MCS

Controlling the movements of our forces is accomplished with the Maneuver Control System (MCS). The MCS provides computer-aided decision support to tactical commanders and staffs at Corps through battalion levels. Critical battlefield information can be collected and analyzed, with subsequent battle plans, orders, estimates and tactical reports produced and distributed rapidly. Purchase of the militarized MCS computers was completed in FY87. The non-developmental items (NDI) were bought out in FY88. The militarized device has been fielded to V and VII Corps in Europe, and III Corps at Fort Hood. Fielding of the NDI hardware began with III Corps in FY89, and all fieldings, both NDI and militarized, are expected to be completed in FY91. Since MCS is the lead C2 program of ATCCS, it is developing the initial force level control software for use by all five of the battlefield functional area C2 systems. The program has been successful in meeting its block objectives and has substantial momentum. The FY91 MCS request provides the funds to complete software segment 11 (Initial Force Level Control System) and prepare for operational testing using the ATCCS Common Hardware/Software (CHS) for transition in FY93.

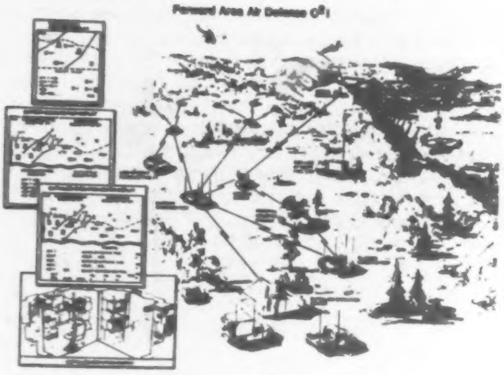
MANEUVER CONTROL SYSTEM

AFATDS

The Advanced Field Artillery Tactical Data System (AFATDS) will provide automated fire support in the Army Tactical Command and Control System (ATCCS) architecture in support of combat operations, fire planning and the commander's scheme of maneuver. AFATDS will accomplish this by providing full automation of all fire support assets in the execution of close combat, counterfire and deep battle operations. AFATDS will automatically implement a commander's detailed guidance of operational planning and execution to include movement control, target value analysis, and fire support. On 11 October 1989, the approval was granted to proceed to Full Scale Development (FSD). This decision set the stage for the software development contract award in March 1990. FY91 brings the design of Version 1 Software to the Critical Design Review where software coding will be initiated. A demonstration on the portability of a portion of the Concept Evaluation Software to the Army Tactical Command and Control common hardware will be conducted.

FAADC2

Air Defense command and control in the forward area will be performed by the Forward Area Air Defense Command and Control (FAADC2) of the Forward Area Air Defense System (FAADS). The FAADS consists of weapon delivery elements linked by FAADC2 which also integrates FAADS with the supported forces. The FAADC2 element acquires, correlates and disseminates a composite air picture gathered from a family of sensors and identification equipment (ground and aerial, active and passive) with an automatic data processing and distribution capability. The FAADC2 will correct serious deficiencies in targeting, air defense operations and force integration. This is achieved through processing and dissemination of aircraft alerting and cueing data from sensors, control orders and other air defense command and control data. A demonstration of the system and initial Software Qualification Testing (SWQT) will be conducted in FY91. FY91 research, development, testing and evaluation (RDTE) funding will be used to begin assembly and test of subsystems and integration with weapon systems, to conduct initial command and control technical testing and to prepare for the Logistics Demonstration.


Forward Area Air Defense C^{2}I

CSSCS

As one of the principal nodes of the ATCCS, Combat Service Support Control System (CSSCS) supports the planning and decision making processes of the theater and tactical level commander. CSSCS furnishes resource management information for the functional areas of logistics, medical, financial and personnel. CSSCS provides an integrating capability for the Combat Service Support (CSS) functional areas and interfaces between ATCCS and the CSS Standard Army Management Information Systems (STAMIS). The system provides an essential decision support system to both the force level and CSS commanders. The CSSCS will be deployed at separate brigades and armored cavalry regiments, maneuver and combat aviation brigades, division, corps and echelons above corps. FY90 major milestones include a Milestone I/II review, development of the Version 2 software package and additional operational experimentation with the system at the ATCCS Experimentation Site (AES) at Fort Lewis, Washington. FY91 RDTE funds will be used to support award of the full scale development contract, design CSSCS Segment 3 software to provide ATCCS initial capabilities for operational readiness assessments, and sustainment planning to support combat operations. An additional FY91 goal is to complete integration of Maneuver Control System Segment 11 [Initial Force Level Control System (IFLCS), electronic maps, and Enhanced Position Location Reporting System (EPLRS) communication interface capabilities] common command and control software into the CSSCS processing architecture.

CHS

The Common Hardware/Software (CHS) program consists of 3 basic versions of common hardware (handheld, portable, transportable) for the ATCCS. CHS will be available to the five Battlefield Functional Area (BFA) Program Managers as building blocks for ATCCS. With CHS, emphasis is placed on restricting the number of unique tactical hardware and software systems that are being fielded by the Army in order to minimize cost and maximize continuity of operations through commonality and standardization. FY91 activities include delivery of CHS to the BFA Program Managers to conduct their hardware and software system integration, development and testing. Each BFA will use the test results as input to its CHS production decision. The Maneuver Control System (MCS) is expected to be first in FY92.

SINCGARS

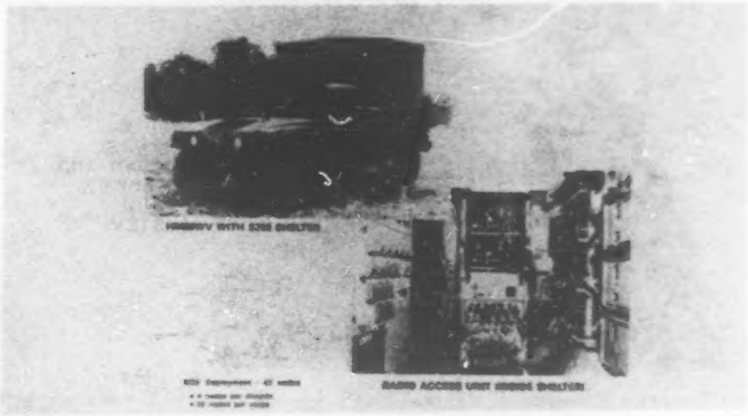
The Single Channel Ground and Airborne Radio System (SINCGARS) will serve as the backbone of the Army combat net radio and provide voice and data communications for tactical command and control. SINCGARS is a family of lightweight, secure VHF/FM radios with greatly improved reliability over the radios which they replace. It can operate in an electronically hostile environment using an anti-jam technique known as frequency hopping. SINCGARS radios are configured in manpack, vehicular, and airborne versions. A modular approach using a single receiver-transmitter allows SINCGARS to replace five currently fielded radios. A total of 350,582 ground and 14,220 airborne radios will be procured through 2008. A limited fielding to Korea took place in December 1987. Limited initial fielding to Army units in the Southern Command took place in 1989. Major unit fieldings began in FY90 to Eighth U.S. Army. FY90 Congressional language provides for an airborne radio option award and a ground option award. Both these awards follow operational testing which is scheduled for completion in June 1990. Congressional direction deferred planned contracts for a Secure Remote Control Device, vehicular and airborne installation kits. A contract for production stretch-out of the current airborne option to reflect a low rate production cap of 730 radios per month is being implemented. This will prevent a break in production pending award of the follow-on option on the ground radio in FY90. FY91 contracts will include follow-on options to both airborne and ground contracts.

SINGLE
CHANNEL
GROUND AND
AIRBORNE
RADIO
SYSTEM

MSE

The Mobile Subscriber Equipment (MSE) is a secure, automatic digital area communications system which will provide mobile and stationary users at Corps and division level with voice, data, and facsimile capability. The underlying concept of MSE is to better support the AirLand Battle area communications provided at Corps and below. MSE is more mobile, less manpower intensive, and more survivable than the existing area communications facilities. The force structure identified in the current MSE contract will be totally equipped by 1994 with equipment that provides multiple communications nodes and network features which automatically bypass and reroute communications around damaged or inoperative nodes. MSE will greatly facilitate operations through its modular signal organization structure, mobility, and quick set-up and displacement capability. The system is interoperable with Joint Tactical Communications Program (TRI-TAC) equipment, combat net radio, commercial telephone systems, and NATO communications networks.

Procurement from the first four of seven contract awards will equip and field 16 Corps signal battalions, 19 division signal battalions with associa[illegible] MSE division equipment, and the Fort Gordon and Fort Sill training bases. A Follow-On Operational Test and Evaluation was concluded successfully in November 1988. The results of this test showed MSE is operationally effective and significantly better than the currently fielded Area Communications equipment. Two division sets remain to be procured and will complete the acquisition of MSE for all Echelon Below Corps forces.

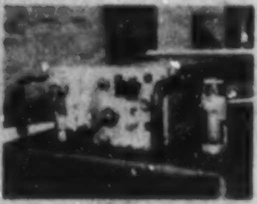


ADDS

Tactical near real-time data distribution will be performed by the Army Data Distribution System (ADDS). The ADDS will give combat commanders the capability of meeting near real-time data communications and position location reporting requirements. The ADDS consists of two systems, the Enhanced Position Location Reporting System (EPLRS), a joint Army/Marine program, and the Joint Tactical Information Distribution System (JTIDS), a tri-service program. The ADDS system will support data communications requirements in the five functional areas of air defense, intelligence/electronic warfare, fire support, maneuver control and combat service support.

The EPLRS portion of the ADDS program completed Technical Testing in March 1989. The hardware build phase of the Pre-Planned Product Improvement production contract will be awarded early in 1990 and includes fixes to problems surfaced during technical testing. FY90 research and development (R&D) efforts are directed toward Very High Speed Integrated Circuit (VHSIC) technology insertion and Net Control Station (NCS) downsizing. The JTIDS program will continue with Class 2M Terminal and NCS development through FY90. Following completion of comprehensive testing of the ADDS, FY91 funding will procure EPLRS equipment for operational testing.

ENHANCED PLRS USER UNIT
(LOW SPEED DATA DISTRIBUTION)



JTIDS CLASS 2M TERMINAL
(HIGH SPEED DATA DISTRIBUTION)

SATELLITE COMMUNICATIONS

Army's Satellite Communications Program consists of the Ground Environment of the Defense Satellite Communications System (DSCS), which includes both the strategic and tactical Ground Mobile Force Tactical Satellite Communication Program. The global Defense Satellite Communications

System (DSCS) satisfies unique and vital command, control, and intelligence communications requirements that have been validated by the Joint Chiefs of Staff (JCS).

The FY91 program will continue to increase system capability, reliability, security, and flexibility worldwide through the procurement of new communications equipment; new satellite control equipment; operations and maintenance training simulators; and high altitude electromagnetic pulse (HEMP) protection equipment and techniques.

In FY91, the Army will continue to increase the capacity of the global DSCS system to satisfy command, control, communications and intelligence (C3I) requirements validated by JCS as well as to upgrade DSCS III satellite platform control and communications payload control to enhance system and network operation and maintenance. In FY91, the Army also continues upgrade improvements to the AN/TSC-85A and AN/TSC-93 terminals that have been deployed to tactical units worldwide, as well as completes concept testing for the new tactical control AN/TSQ-XX subsystem.

In the worldwide ultra high frequency (UHF) Fleet Satellite Communication/Air Force Satellite Communication (FLTSAT/AFSAT) system, the Army's FY91 program calls for the development of a demand-assigned, multiple access Time Devices Multiple Access (TDMA) with embedded Communication Security (COMSEC) in support of the new LST-5B terminals as well as to enhance operation of previously procured Army, Navy, and Air Force UHF terminals deployed and operating in the existing system.

The Army's full scale development effort in support of the planned extremely high frequency (EHF) Military Strategic/Tactical Relay (MILSTAR) system is to continue development, test, and acceptance of the 15 AN/TSC-124 terminals. Recent AN/TSC-124 interoperability testing was successfully accomplished between Army, Navy, and Air Force MILSTAR terminals through the MILSTAR satellite simulator. The 15 developmental AN/TSC-124 MILSTAR terminals will continue to be tested with emphasis being placed on increased reliability. Following completion of the development and test phases, the 15 AN/TSC-124 terminals will be used in the Initial Operational Capability (IOC) MILSTAR system specified by JCS and then returned to the factory to be upgraded for operational use.

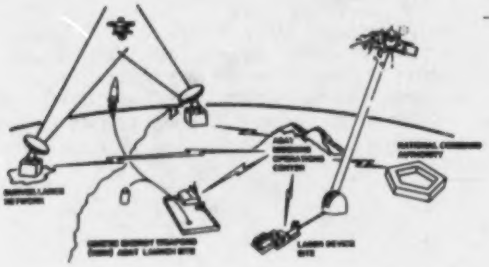
ARMY RDA SPACE ACTIVITIES

Space has become a fourth dimension for national defense along with land, air, and sea. The Army continues to support the long-standing direct receipt of National capabilities to the tactical forces. Space activities offer real time capabilities to see as deep as necessary to help the commander in the deep attack of enemy forces. The Army's space commitment is further demonstrated by taking a leading role in the Military Man In Space program. The Army has completed all the required steps needed to formally schedule with NASA the flight of Army mission specialist astronauts to conduct the future Terra Scout space experiment. This commitment has challenged the Army to pool the appropriate human, material, and financial resources in order to create a growing cadre of space experts and to develop space systems that support Army mission requirements. Efforts to consolidate most of the Army space research, development and acquisition (RDA) in a single space integration project (in PE 63006A) within the R&D community beginning in FY90 further highlight our commitment. The consolidation of space R&D will give continuity to the Army's space effort and eliminate any duplication. The Strategic Defense Command programs, which account for around one-third of the overall Strategic Defense Initiative budget, are covered in the last section of this statement.

KINETIC ENERGY ANTI-SATELLITE SYSTEM

Anti-satellite (ASAT) weapons and their command and control elements constitute the space forces necessary to execute space control operations.

ASAT SYSTEM



The objective of the Kinetic Energy ASAT System is to ensure access to space. The Army has established a Joint Program Office (JPO) under the command of a general officer. The Defense Acquisition Board decision confirmed the Army lead of the joint ASAT JPO and selected land basing for the Kinetic Energy ASAT System. An initial Cost and Operational Effectiveness Analysis and a Test and Evaluation Master Plan have been developed along with a life cycle cost estimate for the kinetic energy weapon system and the surveillance and Battle Management, Command, Control and Communications (BM/C3) portion of the program.

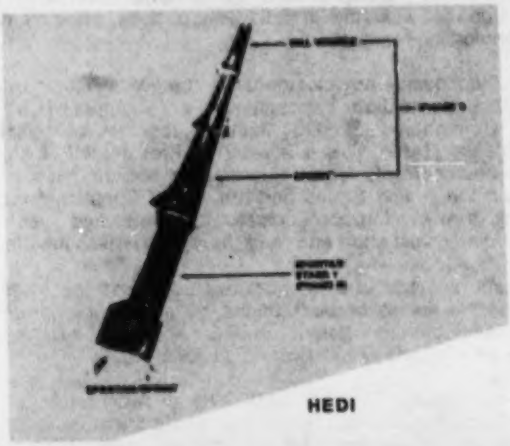
STRATEGIC DEFENSE

The Army is a key participant in the Strategic Defense Initiative (SDI), with over 30 years experience in research and development of strategic defense systems. In much the same way as Army successes provided the foundations for the nation's space program, Army accomplishments in its ballistic missile defense (BMD) program provided much of the technology base when President Reagan issued a call for the creation of Strategic Defense Initiative (SDI). The U.S. Army Strategic Defense Command is responsible for the Army's contribution to SDI through multiple programs, many of which already existed when SDI was created. These programs provide continuing research and early demonstration of BMD technology in five key areas:

- Surveillance, Acquisition, Tracking and Kill Assessment (SATKA) includes radars, optical sensors, laser sensors, and signature measurement programs. The Ground Based Radar (GBR) program provides tracking and identification of incoming targets. The Ground Based Surveillance and Tracking System (GSTS) is a rocket borne sensor probe which provides early warning, tracking and discrimination. The Airborne Optical Adjunct (AOA) program is transitioning to the Airborne Surveillance Testbed (AST) for future optical and laser tracking technologies.

- Directed Energy Weapons (DEW) include both weapons development and target discrimination technology efforts. The Ground Based Laser (GBL) project will demonstrate the feasibility of using high power lasers to destroy hostile targets in space. The Neutral Particle Beam (NPB) will be able to destroy ballistic missiles in boost and post-boost phases as well as reentry vehicles. It is also designed to discriminate real targets among decoys and other objects in space.

- Kinetic Energy Weapons (KEW), which utilize hit-to-kill technologies, have the ability to acquire, track, and intercept high speed targets. The High Endoatmospheric Defense Interceptor (HEDI) is a high velocity (MACH 15) interceptor which would destroy reentry vehicles within the atmosphere; while the Exoatmospheric Reentry vehicle Interceptor Subsystem (ERIS), a ground based interceptor (GBI) project, is designed to intercept weapons outside the atmosphere. Both use non-nuclear kill technology. Advanced research is also ongoing in hypervelocity weapons which use electrothermal and electromagnetic energy to propel projectiles at very high velocities.



HEDI

- Systems Analysis/Battle Management (SABM) provides control of the complex multi-layered defense system. The Army is focusing on mid-course and terminal battle management of weapons and sensors for both continental and theater defense. Additionally, the Army is developing the prototype software and hardware for fixed and mobile command centers which provide the human commander with the BM/C3 functions for battle planning and execution. Experiments in SABM are being conducted to validate, through simulation, the ability to process the necessary sensor data, make timely decisions, and control weapon systems.

- Survivability, Lethality, and Key Technologies (SLKT) programs focus on survivability enhancement measures, evaluation of enemy countermeasures, reduction of uncertainties in lethality and vulnerability, and the development of materials to support system concepts.

In September 1987 and October 1988 the Defense Acquisition Board approved the transition from concept definition to demonstration/validation for a phased strategic defense system. The Army systems included in this initial phase are the ERIS, GBR, GSTS, and the ground portion of battle management. Component systems in follow-on phases will continue to undergo basic technological research.

"Spin-offs" from technology advancements in strategic systems offer the potential to revolutionize tactical capabilities. For example, U.S. Army Strategic Defense Command (USASDC) technologies may be utilized for Theater Missile Defense (TMD). This is a result of Presidential guidance to expand research on technologies for defense against ballistic missiles of all ranges that threaten the United States and our Allies. Consistent with this guidance, the Army is examining architectures, concepts, and systems for theater missile defense against short and medium range ballistic missiles.

The TMD concept definition and architecture studies with the Allies have been completed and the results of these efforts are being incorporated into candidate multinational architectures for NATO. Additional analyses are ongoing to determine the effects of arms control negotiations.

The Extended Air Defense Testbed (EADTB) is an Army program (SDIO funded) that will provide the facilities, hardware, and software necessary to conduct simulations and to support analyses of TMD issues. The EADTB concept features testbed nodes at each of several participating locations in both Europe and CONUS. The United Kingdom node is under development and a contract has been awarded to develop the two U.S. nodes and to provide integration of the testbed. In addition, the Army, in conjunction with SDIO, has entered into an agreement to develop a testbed for Israel.

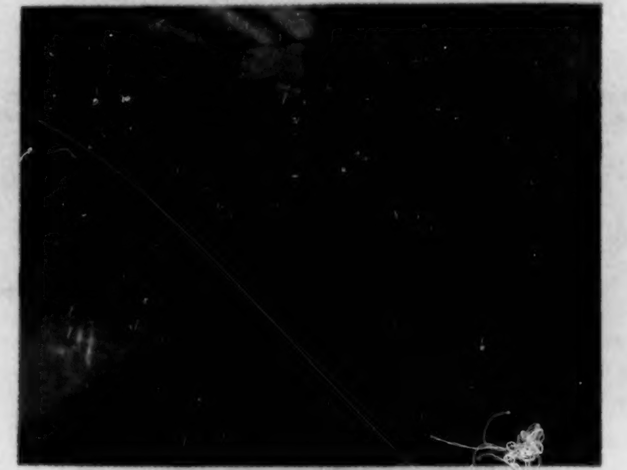
The Army is also conducting extensive research into systems capable of providing active defense against the TMD threat. The Extended Range Intercept Technology (ERINT-I) program will develop and demonstrate a pre-prototype missile and fire control system. In addition, the Army, in conjunction with SDIO, has entered into an agreement to develop and demonstrate Israeli ARROW missile technology against surrogates TMD targets. To extend the capability of currently fielded air defense against theater missiles, the Theater High Altitude Area Defense (THAAD) concept is being explored. The Invite, Show, and Test (IST) program to evaluate and test U.S. and Allied systems, subsystems, and components with possible near term TMD applications has successfully been completed for seekers and sensors. Nine additional IST experiments have been identified, but it appears that the program will have to be cancelled due to higher priority programs in FY90.

An integral part of the U.S. Army Strategic Defense Command mission is management of the U.S. Army Kwajalein Atoll (USAKA) as a National range. It supports the strategic offensive and defensive requirements for all three military departments and other defense and non-defense agencies to include NASA and the Department of Energy. Increases in the FY91 budget are primarily the result of additional funding for environmental compliance mitigation ($5.0M), physical/operations security upgrades ($5.OM), and implementation of the build-to-lease program to provide family and unaccompanied personnel housing for contractors.

AUTOMATIC TEST EQUIPMENT

The Army's automatic test equipment (ATE) consists of the Test, Measurement and Diagnostic Equipment (TMDE) and calibration equipment. These systems provide equipment, state-of-the-art technologies, hardware calibration and standards, and support for the testing and diagnosis of major fielded weapon systems, e.g., Hawk, Multiple Launch Rocket System (MLRS), AH-64 Apache, CH-47D Chinook, Joint Tactical Fusion, Forward Area Air Defense System (FAAD), Abrams tank, and the Bradley Fighting Vehicle (BFV). The introduction of new ATE and sustainment of fielded ATE is essential to the success of the Army's Force Modernization Program and critical for the readiness and sustainment of new and presently fielded weapon systems.

The FY91 funds will continue the development and procurement of test measurement equipment, calibration standards and hardware, accessories, Integrated Family of Test Equipment (IFTE), Commercial Equivalent Equipment (CEE), Contact Test Set (CTS), and other ATE systems. The low rate initial production (LRIP) contract for IFTE was awarded March 1989.



IFTE BASE SHOP TEST STATION (HAWK)

TECHNOLOGY BASE

Recent rapidly changing world events, increased third world military capability, and our national strategy require a modern, ready land force for deterrence and defense. The resultant increased uncertainty and risk associated with this and other global events, such as expanding foreign economic and technological changes, demand more than ever a strong technology base.

THE STRATEGIC ENVIRONMENT

U.S. A GLOBAL POWER ... WITH GLOBAL INTERESTS

THE NEW REALITY

- EVOLVING SUPERPOWER RELATIONS, BUT SOVIET THREAT REMAINS
- POTENTIAL IMPACT OF ARMS CONTROL AGREEMENTS
- INCREASING THIRD WORLD MILITARY CAPABILITY
- NATIONAL PRIORITIES IN TRANSITION

NATIONAL STRATEGY REQUIRES MODERN, READY LAND FORCES FOR DETERRENCE AND DEFENSE - HEAVY, LIGHT AND SOF

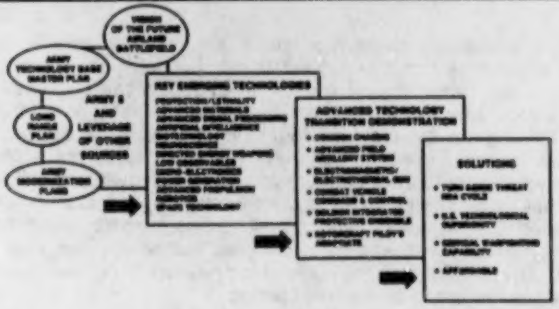
The Army Technology Base represents an indispensable corporate investment to counter the threat and maintain our technological superiority on the battlefield. The Technology Base is divided into three areas, each designed to bring technology to various stages of maturity. The Basic Research (6.1) program exploits and identifies technological opportunities and provides an important interface with university and industry research. The Exploratory Development (6.2) program matures technology opportunities and evaluates technical feasibility for increased warfighting capability, and the non-system specific Advanced Development (6.3A) program demonstrates technologies to speed the transition of matured technology into Full Scale Development. The stability of the Technology Base Program is directly affected by the stability of the associated funding.

ARMY TECHNOLOGY BASE MASTER PLAN

In 1989, the Army published the first Army Technology Base Master Plan (ATBMP) which includes our resource-constrained Technology Base Investment Strategy. The ATBMP provides thorough, top-down guidance and focus to Army research and development activities. The basic principles of the Army Technology Base Investment Strategy are to:

- Ensure the Technology Base program supports the Army's warfighting capability needs
- Balance the Technology Base: (1) near, mid, and far term needs; (2) technology push/requirements pull; (3) between weapons systems & other battlefield requirements
- Distribute Technology Base resources across four areas: (1) future systems (50%), (2) supporting capabilities (10%), (3) systemic issues (15%), (4) key emerging technologies(25%)
- Seize and retain the technology initiative
- Enhance return on investments by leveraging research and development (R&D) outside the Army
- Reduce the time from system concept to successful fielding through focused Advanced Technology Transition Demonstrations (ATTDs)
- Restore stability to the Technology Base
- Provide top-down guidance to create an atmosphere which fosters technology initiative and pursuit of promising, innovative opportunities.

ARMY TECHNOLOGY BASE STRATEGIC PLANNING INITIATIVE


VISION OF THE FUTURE AIRLAND BATTLEFIELD
ARMY TECHNOLOGY BASE MASTER PLAN
LONG RANGE PLAN
ARMY MODERNIZATION PLANS
AND LEVERAGE OF OTHER SOURCES
KEY EMERGING TECHNOLOGIES
PROTECTION/LETHALITY
ADVANCED MATERIALS
ADVANCED SIGNAL PROCESSING
ARTIFICIAL INTELLIGENCE
BIOTECHNOLOGY
DIRECTED ENERGY WEAPONS
LOW OBSERVABLES
MICRO-ELECTRONICS
POWER GENERATION
ADVANCED PROPULSION
ROBOTICS
SPACE TECHNOLOGY
ADVANCED TECHNOLOGY TRANSITION DEMONSTRATION
COMBAT VEHICLE COMMAND & CONTROL
SOLUTIONS
U.S. TECHNOLOGICAL SUPERIORITY
CRITICAL WARFIGHTING CAPABILITY
AFFORDABLE

One of the most important strategies outlined in the ATBMP is technology transition for force modernization. Force modernization requires anticipation of the threat and the design of a defense long before the threat actually appears. It is therefore imperative that the technology base deliver timely and affordable technologies in support of advanced systems and concepts. This requires a close linkage between the technology base and Army force modernization plans. These modernization plans greatly improve the focus of the technology base since they provide definite windows of opportunity for technology insertion into next generation and future Army weapon systems.

Our resource-constrained modernization plans enable the planning and execution of Advanced Technology Transition Demonstrations (ATTDs) which speed the maturing of advanced technologies needed by next generation and future systems. The Army has 13 ATTDs which account for approximately one-half of the Army 6.3A budget.

ADVANCED TECHNOLOGY TRANSITION DEMONSTRATIONS (ATTDs)

CRITERIA

- RISK REDUCING "PROOF OF PRINCIPLE" DEMONSTRATIONS CONDUCTED IN AN OPERATIONAL ENVIRONMENT RATHER THAN A LABORATORY ENVIRONMENT
- POTENTIAL FOR ENHANCED MILITARY OPERATIONAL CAPABILITY OR COST EFFECTIVENESS
- DURATION OF THREE YEARS (TYPICALLY)
- A TRANSITION PLAN IN PLACE (APPLICATIONS AND WINDOWS)
- ACTIVE PARTICIPATION BY THE USER COMMUNITY (PROPONENT)
- PARTICIPATION BY THE DEVELOPER (SERVE AS PROJECT MANAGER)

The FY91 budget request reflects our intensive effort in the past year to support the evolutionary technologies needed for our next generation systems while vigorously pursuing the most promising advanced technologies offering future revolutionary warfighting capabilities.

FUTURE BATTLEFIELD CHARACTERISTICS

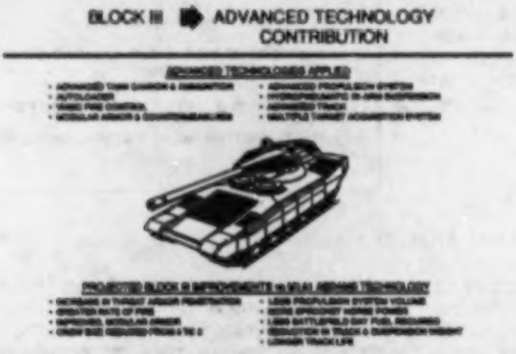
- LIGHTWEIGHT, HIGHLY MOBILE AND LETHAL
- LESS MANPOWER RELIANT/ROBOTICS
- MOBILITY/SURVIVABILITY BUILT-IN
- VEHICLE FAMILY/MODULAR EQUIPMENT
- LOW SIGNATURE, "INVISIBLE EQUIPMENT"
- JAM RESISTANT, SELF-HEALING COMMAND, CONTROL, COMMUNICATIONS ASSETS
- AUTONOMOUS TARGET ACQUISITION AND KILL CAPABILITY
- ELECTRONIC WARFARE TO DESTROY/DISRUPT/DECEIVE

ARMOR/ANTI-ARMOR

Past technology base investments in the Armor/Anti-Armor (A3) area have led to proof-of-principal demonstration of the Advanced Tank Cannon (ATAC) which will permit our Block III tank to overmatch the threat. With the support of Congress, we have initiated an aggressive electrothermal and electromagnetic launch tank gun technology base program. This budget reflects significant increases in funding for the exploitation and demonstration of electrothermal gun propulsion for future tanks. While electrothermal gun propulsion offers projectile velocities beyond 2 kilometers per second, we are also pursuing electromagnetic launch gun propulsion technology with the potential for projectile velocities as high as 4 kilometers per second. We are developing the supporting technologies required to make this a practical weapon system; for example, power conditioning, projectile and terminal ballistics. Electric gun technology offers not only leap-ahead lethality, but also significant improvements in logistics and survivability. In keeping with the Army's intent to pursue appropriate joint and cooperative programs with other military services and agencies, the electric gun system program is being performed in cooperation with the Defense Advanced Research Projects Agency (DARPA), the Defense Nuclear Agency (DNA), the Balanced Technology Initiative Office and the U.S. Navy. At the request of Congress, the Army Science Board has completed its first review of our electric gun technology program and found it to be on track. This budget continues to support other technologies critical to ensuring our lethality and survivability superiority over threat armor systems. To this end, it includes continued funding for the Army/DARPA/USMC armor/anti-armor program which has been so successful to date in leveraging the creativity of American industry in addressing this vital area of our national defense.

ARMORED SYSTEMS

The Armored Systems Modernization Program (ASMP) is an example of how the Army has focused its technology programs to meet its critical modernization needs. It is also an example of our management initiative to preserve the focus of the technology base in support of the development of the seven systems contained in the ASMP. The Program Executive Officer for ASM has been given total authority and responsibility for the entire ASMP including the associated technology base programs required. Two ATTDs are key to the success of the ASMP. The Component Advanced Technology Test


BLOCK III ➡ ADVANCED TECHNOLOGY CONTRIBUTION

Bed will demonstrate critical component technologies in time for Full Scale Development of the Block III tank. Technologies to be integrated and demonstrated on a surrogate M1 chassis include: Advanced Tank Cannon (ATAC) with autoloader, advanced propulsion, standard Army vetronics architecture, advanced sensors and advanced survivability techniques. The Common Chassis ATTD will, in a competitive environment, demonstrate technologies critical to achieving the required mobility for Block III tank, the Advanced Field Artillery System (AFAS), Combat Mobility Vehicle (CMV) and the Future Infantry Fighting Vehicle (FIFV). Competing advanced gun propulsion technologies for the AFAS will be demonstrated in FY91 for increased range, increased rate of fire, improved survivability and reduced logistics burden.

AVIATION

Consistent with the Army Aviation Modernization Plan, our aviation technology base focuses on three areas vital to the United States' maintaining its world-wide pre-eminence in rotorcraft. In cooperation with NASA and DARPA the Rotorcraft Pilot's Associate (RPA) ATTD will yield the integrated, automated cockpit of the future by means of capitalizing on this nation's strength in microelectronics, artificial intelligence, computers, software, display technology and advanced sensors. This ATTD integrates and demonstrates advanced technologies for adverse weather pilotage, integrated weapons, aided target recognition, integrated/automated avionics, advanced sensors, and integrated aircraft survivability equipment. Major advancements in lethality, survivability, versatility and safety will result. The Army's small turbine engine portion of the Tri-Service Integrated High Performance Turbine Engine Technology (IHPTET) program is fully funded to maintain our pre-eminence in this class of engine. Similar past investments in the Army Demonstration Engine program have yielded the highly successful T-800 engine now in development for the LHX. Working with

NASA and the USMC, we are pursuing critical technologies for Army air vehicles of the future with the objective of increased speed, agility, safety, survivability, deployability and versatility. The Army/NASA Crew Station Research and Development Facility at the NASA Ames Research Center, will be networked with SIMNET. This will demonstrate how we can reduce the time from concept to development of future aviation systems by designing the Rotorcraft Pilot's Associate cockpit in the simulator and comparing competing technologies in simulated combat scenarios. This not only will assist in man-machine interface improvements, technology trade-offs and timely technology down-selects, it will also result in a more informed, concept based requirement for the integrated, automated cockpit of the future.

DIRECTED ENERGY

The development of the laser and the ability to transmit intense microwave signals add a new dimension to the battlefield. Both lasers and microwave systems can be used as active sensors. At higher intensities they also can serve as anti-sensor or anti-electronic circuit countermeasures. The Army, in FY91, not only is improving its existing sensor system concepts, but is developing the basic components for a new generation of laser and microwave sensor countermeasures. Concurrently, work is underway to reduce U.S. system vulnerabilities to such attack. The Army supports and is a major player in the National Directed Energy program. This is an inter-Service, inter-agency program. In FY91 research will be directed toward susceptibility and effects, hardening, microwave sources, components and systems concepts. A major effort in FY91 will be the joint Services Countermine Demonstration.

LIGHT FORCES

Our technology base supports technologies critical to the modernization of our light forces. Significant programs in this area include the Joint Service Small Arms Program, our revitalized Soldier R&D program and continuing biotechnology progress. The Soldier Integrated Protective Ensemble ATTD will demonstrate a modular head-to-toe individual fighting system for the ground soldier to sustain combat effectiveness while providing balanced protection against the multiple threats and hazards on the modern battlefield.

ROBOTICS

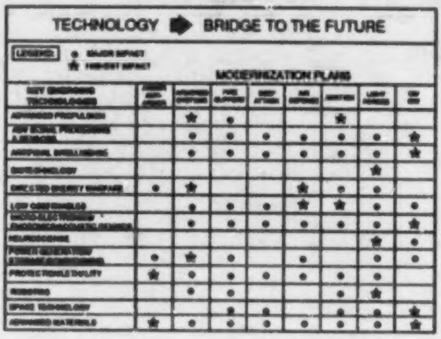
The Army is a leader in the field of robotics research and applications. Since the consolidation of the Services' robotics programs at OSD, the Army has been fully supporting the efforts to organize a comprehensive and coordinated DoD robotics program. The proposed Army program has three thrusts: Unmanned Ground Vehicles, Robotics Assisted Logistics and Technology Improvement. Early joint Army/USMC unmanned ground vehicle systems will be characterized by teleoperation, with follow-on improvements leading to highly autonomous operation. Robotic missions will initially concentrate on observer/scout battlefield functions. The proposed Army FY91 initiatives include extensive efforts in a technology improvement program in cooperation with DARPA.

ADVANCED SENSORS

Advanced sensors and seeker technologies are critical to future combat vehicles and smart weapons. With advanced signal and data processing, such technologies can automatically, or with minimal human assistance, identify targets of interest and, if necessary, guide appropriate countermeasures. This capability will allow soldiers to fight more effectively and at less personal risk on the quick tempo and lethal future battlefield. Technologies required to provide this capability include: radar and acoustic sensors; compact, high throughput signal and data processors; advanced software; and targeting algorithms. Specific programs include second generation focal plane arrays and advanced radars.

KEY EMERGING TECHNOLOGIES

The Technology Base Investment Strategy devotes 25 percent of the Army technology base funding to 13 key emerging technologies which offer the highest return on investment in terms of major improvements in the Army's warfighting capability:



TECHNOLOGY ➡ BRIDGE TO THE FUTURE

LEGEND: ● MAJOR IMPACT ★ HIGHEST IMPACT

	MODERNIZATION PLANS							
KEY EMERGING TECHNOLOGIES	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ADVANCED PROPULSION		★	●			★		
ADV SIGNAL PROCESSING & COMPUTING		●	●	●	●	●	●	★
ARTIFICIAL INTELLIGENCE		●	●	●	●	●	●	★
BIOTECHNOLOGY							★	
DIRECTED ENERGY WEAPONS	●	★			★	●	●	
LOW OBSERVABLES		●	●	●	★	★	●	●
MICRO-ELECTRONICS PHOTONICS/ACOUSTIC SENSORS		●	●	●	●	●	●	★
NEUROSCIENCE							★	●
POWER GENERATION STORAGE & CONDITIONING	●	★	●		●		●	●
PROTECTION/SURVIVABILITY	★	●	●	●	●	●	●	
ROBOTICS		●	●			●	★	
SPACE TECHNOLOGY			●	●		●	●	★
ADVANCED MATERIALS	★	●	●	●	●	●	●	★

The Army Key Emerging Technologies are those technologies considered most essential to be developed to ensure the long-term qualitative superiority of Army weapon systems. These technologies support the Congressionally directed DoD Critical Technologies Plan.

At the request of the Army, the National Academy of Sciences' Board on Army Science and Technology (BAST) has initiated a two-year study of Strategic Technologies for the Army (STAR) to: (1) identify the advanced technologies most likely to be important to the Army in the 21st century; (2) offer technology strategies that the Army should consider in developing their full potential; and (3) project, where possible, the implications for force structure modernization and strategy. The BAST STAR study results will be incorporated in future editions of the ATBMP.

TECHNOLOGY BASE

- TECHNOLOGY TO DETER & DEFEAT
- KEY EMERGING TECHNOLOGIES FOR TECHNOLOGY SUPERIORITY
- AVOID TECHNOLOGICAL SURPRISE
- MODERNIZATION FOR A MORE LETHAL, DEPLOYABLE, VERSATILE & SUSTAINABLE FUTURE ARMY
- ARMY TECHNOLOGYBASE MASTER PLAN IS OUR ROADMAP
- REVOLUTIONARY WARFIGHTING CAPABILITIES:
  - ELECTRIC GUNS
  - SMART WEAPONS
  - DEEP ATTACK
  - AUTOMATIC TARGET RECOGNITION
  - SIGNATURE CONTROL
  - AIRLAND BATTLE MANAGEMENT

OUR BRIDGE TO THE FUTURE ARMY

MEDICAL RESEARCH

Army medical research, development, and acquisition (RDA) programs provide the technology, technical information, and medical materiel to resolve unique military medical deficiencies, prevent casualties, enhance the return to duty rate, and lighten the logistical burden of U.S. forces. Adversarial progress in battlefield technology, with the potential for increased weapon lethality and continuous high-intensity conflict, must be countered to protect the single most critical combat element, the soldier.

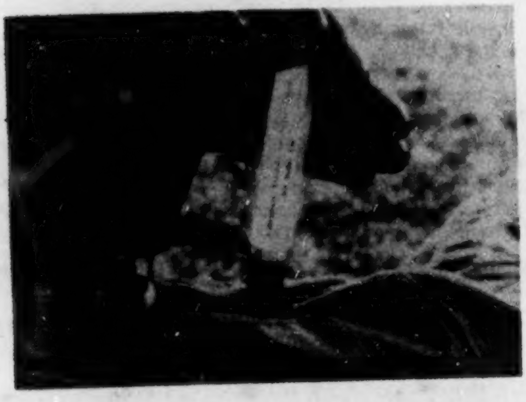
The soldier must be considered a system - a human system that links up with superior technology to fight and win. Sustainment of this soldier system is best achieved through medical RDA programs that prevent illness, injury, and performance degradation. For those soldiers that fall victim of injury or disease, medical RDA programs serve to increase the rate of return to duty. These benefits apply across the spectrum of conflicts, from military operations short of war through high-intensity engagements.

BIOLOGICAL DEFENSE

The international proliferation of biological warfare capabilities poses a threat to U.S. forces. Traditional microbiological, immunological, and biochemical techniques can no longer be relied upon to fully counter potential biological threats. Thus, the Medical Biological Defense Research Program has directed its efforts towards developing vaccines, drugs, and rapid diagnostic products. The thrust is to develop products that will cover broad groups of potential threat agents, as opposed to single agents. Examples of these types of medical products, in various stages of development, include a broad-spectrum antiviral drug, a heptavalent botulinal toxoid, a non-specific immune enhancing drug, and a genetically engineered Rift Valley fever vaccine. These medical countermeasures are scheduled for transition to advanced development, or to contingency deployment status, by the end of FY91.

CHEMICAL DEFENSE

Chemical weapons represent a major threat to U.S. forces. Recent events, particularly in the Middle East, have dramatically demonstrated that warring nations will use any weapon in their inventories, including chemical weapons, to persevere. The Medical Chemical Defense Research Program exists to develop medical countermeasures to prevent and treat chemical agent injuries and death. During FY91, a resin-based skin decontaminating kit (SDR) will become available through the stock fund. Unlike the previous generation SDK, the new product is non-toxic, non-corrosive, and non-irritating, yet is effective against multiple threat chemical warfare (CW) agents. An added benefit is that these qualities allow the SDK to be used in training and familiarization by U.S. forces, instilling confidence. An anti-convulsant (diazepam) to prevent or ameliorate convulsions in severe nerve agent casualties, Convulsant Antidote for Nerve Agents (CANA), will be fielded in FY91.



CONVULSANT
ANTIDOTE
FOR
NERVE
AGENTS

Supplied in an autoinjector, CANA will be administered by "buddy-aid". During FY91, results of initial safety and efficacy testing of topical skin protectants for use against chemical warfare (CW) agents will justify a Milestone 0 decision to transition to Concept Exploration. Topical protectants offer the advantage of preventing skin penetration by CW agents, thus they may redefine the level of protective clothing necessary for operations in a CW environment. Using state-of-the-art assessment methods, information is being collected on the performance degradation resulting from use of CW protective equipment and drugs. This will enable planners to develop more appropriate doctrine to allow combat aviators, C3 personnel, and others to operate more effectively when using these products.

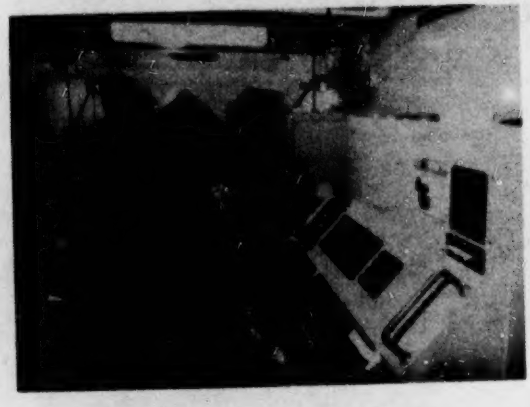
To ensure a coordinated tri-service program of medical defense against biological and chemical weapons, the Army has been designated the Executive Agent for chemical and biological defense.

INFECTIOUS DISEASE PREVENTION AND TREATMENT

Concomitant with the requirement for U.S. forces to defend the worldwide security and national interests of the United States is the responsibility to protect its military personnel against naturally occurring infectious diseases. Endemic diseases caused more hospital admissions during World War II, Korea, and Vietnam than battle and non-battle injuries (other than disease) combined. Malaria, scrub typhus, dengue, other vector-borne diseases, and diarrhea have decimated armies in the past and may do so again in future conflicts. The emergence of drug-resistant strains of disease causing organisms and pesticide-resistant insect vectors has led to a rise in diseases once considered under control. Congress has designated the Army as the Lead Agency for infectious disease research, and the Army maintains a network of overseas laboratories to monitor and study worldwide disease threats. The Infectious Disease Research Program stresses prevention of personnel losses due to infectious diseases, and therapy to rapidly return sick personnel to duty. To this end, a number of significant developments related to the diagnosis, prevention, and treatment of infectious diseases have recently been made by military scientists. By the end of FY91, artemisinin, a new drug for malaria therapy; halofantrine, a prophylactic antimalarial drug; a genetically engineered malaria vaccine, consisting of a malaria immunogen inserted into a carrier hepatitis B vaccine; and a new vaccine against a diarrheal disease, caused by *Campylobacter sp.* bacteria, will be transitioned to advanced development.

COMBAT CASUALTY CARE

Predictions are that future conflicts will be of greater intensity and will result in higher casualty rates than previous conflicts. Improved treatment of combat casualties requires early diagnosis and treatment of shock caused by large volume blood loss. In addition to improved resuscitative fluids, pharmaceuticals that may "buy time" until adequate fluid volume replacement can occur are being investigated. In FY91, a new resuscitative fluid, Hypertonic Saline Dextran, will undergo clinical studies. This innovative product will have broad implications on battlefield doctrine for the stabilization and treatment of hemorrhagic shock casualties. HSD resuscitation requires only one-twelfth of the previously required volume/weight of fluid (a reduction of 6.6 lbs.) and stabilizes the casualty for six to eight hours. Research aimed at reducing mortality and morbidity due to combat head injuries is also a high priority. The improved management of burn wounds is sought through improved dressings, skin substitutes, and epithelial growth enhancement systems. The Combat Casualty Care Research Program also includes the development of synthetic, biodegradable implant materials to replace missing bone segments to accelerate wound healing and simplify final surgical reconstruction. The program also includes efforts to enhance treatment for maxillofacial injury; the Army is the congressionally designated Lead Agency for combat dentistry research. Efforts directed at enhancing transportability of medical materiel through size and weight reduction include field oxygen and medical grade (intravenous) water production systems, a field medical refrigerator, a heated patient liner for casualty transportation, and a wheeled litter carrier. Advanced development of a lightweight hand-held field x-ray has been completed.



RESUSCITATIVE FLUIDS PRODUCTION SYSTEM

COMBAT SYSTEMS HEALTH HAZARDS RESEARCH

On a daily basis, soldiers are faced with a wide array of occupational and environmental hazards. Readiness requires that soldiers train and work under conditions that they are likely to encounter during actual combat. Training in these radical environments (e.g., Mission Oriented Protective Posture/Buttoned-Up, Extreme Cold Weather and Altitude) exposes military personnel to numerous risks from cold, heat, altitude, and other extremes. With advances in modern technology, weapon systems now possess unprecedented firepower and range. One of the detrimental trade-offs of this weapon sophistication process is the increased potential to physically harm the operators of such systems. Occupational hazards in the form of blast overpressure from artillery, toxic fumes and gases from weapons, radiation hazards from laser and microwave devices, and vibration and biomechanical hazards from vehicles and weapons platforms are only a few of the dangers faced by soldiers while performing their military-unique tasks.

The thrust of Combat Systems Health Hazards Research is to identify, quantify, and minimize these health hazards in an effort to maximize soldier performance and reduce the overall incidence of duty-related injuries. In Combat Health Hazards Assessment Research, a study in Evaluating Impulse Noise Damage-Risk Criteria was completed. The results of this study will help to formulate standards for exposure to impulse noise and will help to minimize auditory injuries to soldiers. Another chief accomplishment is the development of a blast exposure facility at Kirtland Air Force Base, which will ultimately provide data leading to new and improved standards for soldier protection. This new data will document the somatic and auditory effects associated with various blast scenarios. A study in Training Injury Prevention Strategies is also in its final stages and will be completed in FY90. Further research has also been completed on the feasibility of high calorie lightweight rations, prevention of heat and cold injury, prevention of altitude sickness, and laser effects on visual function. A microwave bioeffects database is also being established which will document the effects of pulsed microwave exposure on key organ systems. Emerging technologies in Health Hazards Assessment Research include the evaluation of extended-wear contact lenses in military environments, advanced ocular protection from Frequency Agile Laser Systems, a bioeffects database for the Alexandrite Laser System, and efforts toward lightening the force.

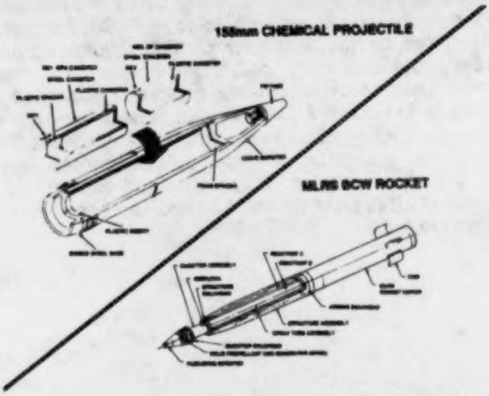
NUCLEAR, BIOLOGICAL, AND CHEMICAL

Nuclear, biological, and chemical (NBC) warfare profoundly affects the way the Army fights. All aspects of warfare, from ground combat to command and control to supply and maintenance operations, must accommodate the added burden of a contaminated environment. With the main Chemical Biological Warfare (CBW) threat changing to third world countries as indicated by the Iran/Iraq conflict, multilateral agreements must be negotiated and light forces must be protected and oriented for the NBC environment. Because of this, the Army places high priority on deterring this form of warfare.

A credible chemical retaliatory capability, combined with a strong NBC defense, form the basis of our deterrent posture. As the Nation seeks to ban chemical warfare through international diplomacy, the Army must continue to develop and maintain a credible deterrent until such time as chemical warfare is no longer a threat to national security.

CHEMICAL WEAPONS

Modernization of our aging stocks of chemical weapons is fundamental to the Army's ability to deter chemical warfare. Binary chemical weapons, which produce lethal chemical agent by the reaction of two nonlethal components in flight to the target, are the heart of our modernization program. Two binary chemical weapons are being developed and produced to meet this need -- the M687 155mm Artillery Projectile and XM135 Binary Chemical Warhead for the Multiple Launch Rocket System. These weapons offer significant advantages in safety, transportation and handling, storage and disposal. The



M687 projectile provides commanders the capability to retaliate with nonpersistent nerve agent to influence the close battle. It will continue in production during FY91.

The XM135 binary chemical rocket warhead, containing a semi-persistent nerve agent, will be used to retaliate against intermediate range targets. All technical, user, and production qualification tests will be completed as it continues in full scale development during FY91.

NBC DEFENSE

Equally important as a credible retaliatory capability is a strong and effective defense against NBC warfare. The Army's doctrinal concept for defense against the effects of NBC warfare agents is predicated on three fundamentals --avoiding contamination, protecting soldiers against agents effects, and decontaminating them following an attack. During FY91, we will continue the development and fielding of equipment to fulfill the needs of these three fundamentals. Examples of each category are described below.

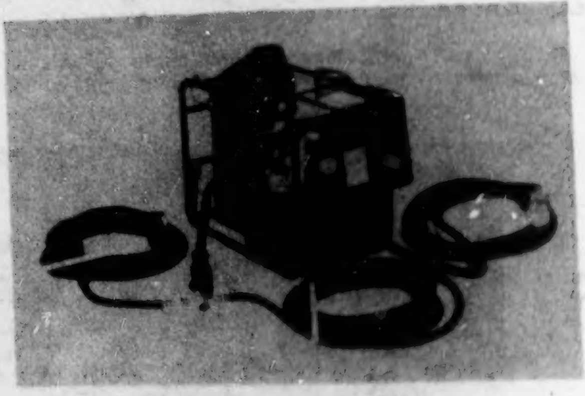
The M1 Chemical Agent Monitor (CAM) offers soldiers significant improvements in detection and identification of chemical agent contamination.

CHEMICAL
AGENT
MONITOR

This hand-held instrument will tell soldiers when it is safe to remove their protective masks, where contamination is located on their equipment so they can decontaminate it, and whether it has been completely decontaminated. It will assist medical personnel in locating and identifying chemical agents on their patients. During FY91, we will procure 3210 more Chemical Agent Monitors for fielding to Army units.

The M40/42 Protective Mask is the first new mask to be fielded in more than 20 years. It provides an improved level of protection from NBC warfare agents, much better visibility and voice communications, and is much more comfortable to wear than the older masks it will replace. Two models are being produced -- an individual soldier mask (M40) and an armored vehicle crewman mask (M42).

The M17 Lightweight Decontamination System greatly increases our ability to clean up following a chemical attack. Now, each battalion-sized unit will have two of these systems to wash down vehicles and equipment with pressurized hot water. It can also be configured to provide shower facilities for decontamination of personnel. During FY91, we will buy more than 500 M17 Lightweight Decontamination Systems for fielding throughout the Army.



LIGHTWEIGHT DECONTAMINATION SYSTEM

SOLDIER SUPPORT

Soldier Support efforts will improve the battlefield effectiveness and survivability of our soldiers. Nuclear, Biological, and Chemical protective clothing and individual equipment items provide the required protection against ballistic/laser hazards, chemical and biological agents, flame and environmental extremes while reducing the individual soldier's equipment weight and heat stress. Food items and food service equipment are designed to meet high nutritional requirements while minimizing the number of food service personnel, procurement costs, and total logistics support requirements. Ethnic foods are being troop tested as enhancements to the current Meals, Ready to Eat (MRE) and Tray Packs. We postulate high troop acceptance which translates into improved morale and nutrition. As the Executive Agent for the DoD Food RDT&E Program, the Army is pursuing biodegradable packaging in compliance with the International Convention for the Preservation of Pollution from Ships and with Public Law 100-200, 29 Dec 87. Airdrop Equipment is being developed to deliver soldiers and supplies safely and efficiently into combat areas. Work on low altitude, fast delivery personnel and cargo parachutes will decrease the vulnerability of aircraft and paratroops, diminish landing zone dispersion, and increase resupply capability, particularly in scenarios such as the recent operation JUST CAUSE.

SOLDIER INTEGRATED PROTECTIVE ENSEMBLE (SIPE)

In FY91, the Army is undertaking a major effort in the area of individual soldier integrated protection. The Soldier Integrated Protective Ensemble (SIPE) is designed to balance the full range of protection against multiple

ADVANCED TECHNOLOGY
FOR THE SOLDIER
● LIGHT WEIGHT MATERIALS
● HIGH STRENGTH POLYMERS
● FLASH PROTECTION
● LOW OBSERVABLES
● ADVANCED COMBAT RIFLE
● PORTABLE ANTITANK WEAPONS
● ELECTRO-OPTICS
● ENERGY DENSE BATTERIES
● MICROELECTRONIC COMMUNICATIONS
● GLOBAL POSITIONING SYSTEMS
● NEW RATIONS e.g. MRE
● SURVIVABLE NBC CLOTHING
● IMPROVED FABRICS
● MICROCLIMATE COOLING
● AIR PURIFICATION
● MICROSENSOR DETECTION KIT
● MULTIPURPOSE CB DECON

battlefield threats and hazards in a modular, head-to-toe, individual fighting system. SIPE concentrates on the soldier as a system; therefore, it will address all items carried by the individual soldier including communications, weapon systems and target acquisition equipment. SIPE is estimated to achieve 30% in weight savings, exclusive of the microclimate cooling system, when compared to the total weight of the conventional clothing components.

SOLDIER ENHANCEMENT PROGRAM

The Soldier Enhancement Program, an $18M FY90 Congressional initiative, will yield a number of improvements such as an improved helmet providing the same level of ballistic protection for 30% less weight compared to the current helmet. Similarly, new synthetic fiber technology will allow the fielding of an improved Hot Weather Battle Dress Uniform with better appearance and increased durability without decreased comfort. Improved laser/ballistic eye armor will also be fielded. These goggles will be lighter, more durable, have higher "see-through" capability, provide expanded laser protection, and remain fully compatible with other soldier items. In the food area, the Soldier Enhancement Program will introduce self-heating Meals, Ready to Eat.

CONCLUSION

This statement presents the major programs in the fiscal year 1991 budget for research, development, and acquisition. This budget totals over sixteen billion dollars, $10.6B for procurement of weapon systems, and $6.0B for research and development. This budget reflects detailed management decisions to ensure that the most is gained for the resources provided. In this stewardship role, the Army is responsible to the American people to secure a modern, well-equipped force in a cost effective manner. Decisions have been made to discontinue some programs in order to adequately fund those programs that will have the highest payoff in the future. Our goal is to continue to assist in the Army mission of deterrence, by providing a well-equipped force, and if that deterrence fails, to provide equipment that is available to meet any threat in any operational contingency. We continue to need the support of Congress to meet this goal.

FY91 RDA BUDGET SUMMARY

APPROPRIATION	FY89	FY90	FY91
AIRCRAFT PROCUREMENT, ARMY	2855205	3715480	1583200
MISSILE PROCUREMENT, ARMY	2579508	2503712	2623500
PROCUREMENT WEAPONS AND TRACKED COMBAT VEHICLES	2671175	2587396	2172600
PROCUREMENT AMMUNITION, ARMY	2020335	1909043	1424400
OTHER PROCUREMENT, ARMY	4658084	3608297	2827500
RDTE	5154184	5418729	6025900
GRAND TOTALS	19938491	19742657	16657100

*TOTALS OF COLUMNS IN THE FOLLOWING PAGES MAY NOT ADD UP DUE TO ROUNDING ERROR.

FY91 BUDGET

AIRCRAFT PROCUREMENT, ARMY

SSN	NOMENCLATURE	FY89	FY90	FY91
	AIRCRAFT			
	FIXED WING			
	GRISLY HUNTER	0.0	9.8	10.4
	RC-12H/K RECON AIRPLANE	61.9	52.0	87.4
	ROTARY WING			
	AH-64 ATTACK HELICOPTER (APACHE)	847.7	1469.5	104.2
	AH-64 ATTACK HELICOPTER (AP)	78.6	0.0	0.0
	UH-60A BLACK HAWK (MYP)	205.7	203.5	272.1
	UH-60A BLACK HAWK (MYP) (AP)	215.5	178.2	197.2
	TOTAL PACKAGE FIELDING	0.0	0.0	16.2
	MODIFICATION			
	INSTALLATION OF MODERNIZATION EQUIPMENT	0.0	82.2	0.0
	OV-1 MOHAWK SURVEILLANCE AIRPLANE	16.1	.2	.2
	RC-12D UPGRADE	39.2	42.6	31.6
	AIRPLANES, RECON, RU-21	3.9	1.5	9.7
	AH-1S ATTACK HELICOPTER (COBRA-TOW)	28.8	5.8	8.0
	AH-64 MODS	2.2	20.7	85.7
	CH-47 CARGO HELICOPTER MODS (MYP)	166.6	178.8	237.8
	CH-47 CARGO HELICOPTER MODS (AP)	80.8	94.9	56.4
	OH-58 OBSERVATION HELICOPTER (KIOWA)	17.3	23.0	24.7
	UH-1 UTILITY HELICOPTER (IROQUOIS)	0.0	9.5	26.8
	UH-60 BLACKHAWK MODS	33.2	40.4	83.5
	OH-58D (KIOWA WARRIOR)	169.3	192.3	48.0
	OH-58D (KIOWA WARRIOR) (AP)	33.6	0.0	0.0
	AIRBORNE AVIONICS	4.5	0.0	0.0
	ASE MODIFICATIONS CLOSE COMBAT	34.8	7.0	11.5
	ACFT 9WW	23.9	19.5	0.0
	SOF AIRCRAFT MODIFICATIONS	69.9	200.2	0.0
	SOF AIRCRAFT MODIFICATIONS (AP-CY)	49.7	125.9	0.0
	TRACTOR HEAVY MODS	0.0	.8	.8
	SPARES AND REPAIR PARTS			
	SPARE PARTS	547.3	534.1	0.0
	SUPPORT EQUIPMENT AND FACILITIES			
	AIRCRAFT SURVIVABILITY EQUIPMENT	49.5	97.7	107.9
	AVIONICS SUPPORT EQUIPMENT	22.2	30.4	43.6
	COMMON GROUND EQUIPMENT	29.5	45.8	67.9
	AIR TRAFFIC CONTROL	0.0	7.7	8.7
	INDUSTRIAL FACILITIES	20.4	22.8	27.8
	SYNTHETIC FLIGHT TRAINING SYSTEMS	0.0	9.8	10.4
	AVIATION NON SYSTEM TRAINING DEVICES	0.0	0.0	0.0
	WAR CONSUMABLES	3.1	4.2	4.6
	AIRBORNE COMMAND/CONTROL CONSOLES	0.0	4.7	0.0
	TOTAL AIRCRAFT APPROPRIATIONS	2855.2	3715.5	1583.2

FY91 MISSILE PROCUREMENT, ARMY

SSN	NOMENCLATURE	FY89	FY90	FY91
	OTHER MISSILES			
	SURFACE-TO-AIR MISSILE SYSTEM			
	CHAPARRAL	56.7	25.4	0.0
	NON LINE-OF-SIGHT MSL (AP-CY)	0.0	0.0	0.0
	ADS HVY MSL SYSTEM (CURRENT YEAR)	85.5	167.2	235.6
	ADS HVY MSL SYSTEM (AP-CY)	23.8	31.7	36.2
	HAWK MISSILE (MYP)	0.0	13.4	0.0
	OTHER MISSILE SUPPORT	5.0	1.0	4.9
	PATRIOT (MYP)	779.4	896.6	883.2
	PATRIOT (MYP) (AP)	37.3	0.0	0.0
	STINGER (MYP)	241.3	114.7	252.4
	LINE-OF-SIGHT REAR FIRE UNIT (LOS-R)	92.3	114.1	97.4
	LINE-OF-SIGHT REAR FIRE UNIT (LOS-R) (AD-CY)	0.0	0.0	25.7
	AIR-TO-SURFACE MISSILE SYSTEM			
	LASER HELLFIRE SYSTEM	204.6	98.9	123.3
	ADVANCED ANTITANK WPNS MED	0.0	0.0	15.6
	ANTI-TANK/ASSAULT MISSILE SYSTEM			
	TOW 2 SUMMARY	143.1	105.4	219.5
	MULTIPLE LAUNCH ROCKET SYSTEM (MYP)	409.9	432.7	313.9
	MULTIPLE LAUNCH ROCKET SYSTEM (AP)	20.8	63.4	59.6
	ARMY TACTICAL MISSILE SYSTEM	66.4	85.9	168.7
	ARMY TACTICAL MISSILE SYSTEM (AP)	4.3	7.6	18.5
	TOTAL PACKAGE FIELDING	0.0	0.0	9.3
	MODIFICATIONS			
	PATRIOT MODS	43.7	19.2	20.9
	CHAPARRAL MODS	8.1	0.0	0.0
	HAWK MODS	27.1	28.4	43.6
	TOW MODS	33.8	27.6	45.4
	DRAGON MODS	18.0	0.0	0.0
	LANCE MODS	15.4	0.0	0.0
	PERSHING MODS	1.0	0.0	0.0
	TRACTOR RIG	0.0	2.6	8.1
	MLRS MODS	22.9	28.2	17.5
	DEPOT MOD APPLICATIONS	0.0	34.5	0.0
	SPARES AND REPAIR PARTS			
	SPARES AND REPAIR PARTS	211.2	176.3	0.0
	SUPPORT EQUIPMENT AND FACILITIES			
	AIR DEFENSE TARGETS	16.8	16.4	12.5
	ITEMS LESS THAN $2.0M (MISSILES)	2.3	2.1	3.6
	PRODUCTION BASE SUPPORT	9.0	10.5	8.4
	TOTAL MISSILE PROCUREMENT, ARMY	2579.5	2503.7	2623.5

FY91 PROCUREMENT WEAPON TRACKED COMBAT VEHICLES, ARMY

SSN	NOMENCLATURE	FY89	FY90	FY91
	TRACKED COMBAT VEHICLES			
	TRACKED COMBAT VEHICLES			
	BRADLEY FIGHTING VEHICLES (MYP)	653.5	540.1	657.4
	BRADLEY FIGHTING VEHICLES (MYP) (AP)	30.0	67.7	30.5
	BRADLEY (BFVS) TRAINING DEVICES	0.0	12.3	0.0
	BRADLEY (BFVS) TRAINING DEVICES (MOD)	1.0	0.0	0.0
	REC VEHICLE M88A1	15.0	0.0	0.0
	REC VEHICLE M88A1 (AP)	0.0	0.0	0.0
	ABRAMS TANK SERIES ROLL (MYP)	1080.8	972.4	747.3
	ABRAMS TANK SERIES ROLL (MYP) ADV PROC	332.6	245.0	0.0
	M1SERIES TANK TRAINING DEVICES	0.0	12.9	15.0
	FIELD ARTILLERY AMMO	0.0	45.0	0.0
	MODIFICATION OF TRACKED COMBAT VEHICLES			
	CARRIER, MOD	32.7	0.0	0.0
	BFVS SERIES 0512 (MOD)	35.6	31.8	146.1
	HOWITZER, MED SP FT 155MM M109 (MOD)	27.8	75.5	206.8
	TANK, MI SERIES (MOD)	0.0	36.2	80.1
	9WW	0.6	0.5	0.0
	HOST NATION SUPPORT	13.0	54.0	0.0
	MODIFICATIONS LESS THAN $2.0	.6	0.0	1.0
	SUPPORT EQUIPMENT AND FACILITIES			
	SPARES AND REPAIR PARTS (TCV-WTCV)	244.5	204.7	0.0
	ITEMS LESS THAN $2.0M (TCV-WTCV)	2.0	1.7	1.0
	PRODUCTION BASE SUPPORT (TCV-WTCV)	35.2	22.5	83.2
	REGIONAL MAINT TRAIN SITES-EQUIP	16.2	6.4	10.3
	WEAPONS AND OTHER COMBAT VEHICLES			
	HOWITZER, LIGHT, TOWED, 105MM, M119	30.6	4.0	26.2
	SQUAD AUTOMATIC WEAPON (SAW) 5.56MM	8.2	11.6	12.5
	SOF WEAPONS	0.0	1.9	0.0
	GRENADE LAUNCHER, AUTO, 40MM, MK19-3	12.0	19.7	0.0
	LAUNCHER, SMOKE GRENADE	1.5	1.6	1.7
	MORTAR, 120MM	5.0	10.9	12.3
	M16 RIFLE	22.1	14.2	14.8
	SNIPER WEAPON SYSTEM	2.2	3.8	0.0
	PERSONAL DEFENSE WEAPON, 9MM	7.0	0.0	8.0
	VEH RAPID FIRE WPN SYS-BUSHMAST(MYP)	29.3	18.7	25.5
	VEH RAPID FIRE-BUSHMASTER (AP)	0.4	0.0	2.0
	MODIFICATION OF WEAPONS AND OTHER COMBAT			
	M16A1 RIFLE MODS	2.2	4.0	5.6
	MODIFICATIONS UNDER $2.0M (WOCV-WTCV)	4.5	0.5	0.6
	MODERNIZATION OF EQUIPMENT	0.0	134.3	0.0
	TOTAL PACKAGE FIELDING	0.0	0.0	63.6

FY91 PROCUREMENT WEAPON TRACKED COMBAT VEHICLES, ARMY(cont)

SSN	NOMENCLATURE	FY89	FY90	FY91
	SUPPORT EQUIPMENT AND FACILITIES			
	SPARES AND REPAIR PARTS (WOCV-WTCV)	11.6	12.0	0.0
	ITEMS LESS THAN $2.0M (WOCV-WTCV)	4.9	1.0	2.0
	PRODUCTION BASE SUPPORT (WOCV-WTCV)	8.6	14.0	17.4
	INDUSTRIAL PREPAREDNESS	0.0	6.4	1.6
	TOTAL WEAPON TRACKED COMBAT VEHICLES	2671.2	2587.4	2172.6

FY91 PROCUREMENT AMMUNITION, ARMY

SSN	NOMENCLATURE	FY89	FY90	FY91
	SPECIAL AMMUNITION			
	NUCLEAR WEAPONS SUPPORT MATERIEL	8.9	6.5	6.4
	CONTROLLED ITEMS			
	CTG, 5.56MM, ALL TYPES	81.1	45.3	52.0
	CTG, 7.62MM, ALL TYPES	45.1	28.8	4.2
	CTG, 60MM, SMOKE WPLWCMS M722	4.1	3.6	4.0
	CTG, 60MM, HE M720W/M734 MOF	0.0	12.7	0.0
	CTG, CAL .45, ALL TYPES	1.6	0.6	0.5
	CTG,CAL .50, ALL TYPES	4.6	1.4	3.1
	CTG, 20MM, ALL TYPES	11.7	34.5	9.9
	CTG, 25MM, ALL TYPES	56.1	33.5	89.6
	CTG, 30MM, ALL TYPES	6.5	10.6	9.5
	CTG, 40MM, ALL TYPES	9.6	61.9	2.4
	CTG, 81MM: 1/10 RNG, PRAC, XM880	4.5	0.0	0.0
	CTG, 4.2-IN HE M329A2 W/O FUZE	15.0	0.0	0.0
	CTG, 4.2 IN MORTAR ILLUMINATING	18.7	0.0	0.0
	CTG, 120MM, HE, XM934	6.8	0.0	0.0
	CTG, 120MM, HE W/PD FUZE	14.6	0.0	0.0
	CTG, 120MM, SMOKE, XM929	12.1	0.0	0.0
	CTG, TANK, 35MM, SUBCAL PRDA	2.0	0.0	0.0
	CTG, 105MM, TP-T, M490A1	0.0	7.9	8.7
	CTG, 105MM, DS-TP, M724A1	25.8	39.4	6.5
	CTG, 105MM, APFSDS-T, M900E1	30.9	13.1	67.0
	CTG, 120MM APFSDS-T M829	130.6	0.0	0.0
	CTG, 120MM HEAT-MP-T, M830(MYP)	39.5	0.0	0.0
	CTG, 120MM TP-T M831 (MYP)	44.2	48.9	41.2
	CTG, ARTY, 75MM, BLANK, M337AI	0.0	1.8	0.0
	CTG, ARTY, 105MM BLANK, M395	0.0	0.0	5.7
	CTG, ARTY, 105MM, HERA, M913	0.0	8.0	15.6
	CTG, 120MM TPCSDS-T, M865(MYP)	75.7	85.4	130.5
	PROJ, 155MM, HE, ICM M483	113.1	0.0	0.0
	PROJ, 155MM, SMK, WP, M825	4.5	60.0	0.0

FY91 PROCUREMENT AMMUNITION, ARMY(cont)

SSN	NOMENCLATURE	FY89	FY90	FY91
	PROJ, 155MM, HE, ADAM M731	51.5	82.2	36.9
	PROJ, 155MM, HE, RAAMS M718	22.3	0.0	0.0
	PROJ, 155MM, HE RAAMS M741	21.2	47.4	0.0
	PROJ, 155MM, BASEBURNER, M864	111.7	178.7	118.5
	PROJ. 155MM, TRAINING, M804	15.7	17.0	32.6
	CHARGE, PROPELLING,M155MM GREEN BAG M3	0.0	29.0	0.0
	CHARGE, PROPELLING,M155MM,RED BAG M203	129.7	15.0	0.0
	CHARGE, PROPELLING,M155MM,RED BAG M119	29.1	33.0	0.0
	FUZE, ET, M767	0.0	5.0	3.1
	FUZE, PROMIXITY, M732	0.0	0.0	33.0
	PROJ, 8-INCH, HE, RAP, M650	37.0	0.0	0.0
	FUZE, PD M739/M739A1	0.0	13.7	0.0
	FUZE, MTSQ M577/M577A1	15.5	0.0	0.0
	FUZE, MTSQ M582/M582A1	0.4	0.0	0.0
	FUZE, ET XM762	23.2	35.0	7.2
	PRIMER, PERC, M82	0.7	0.0	0.0
	TRAINING DEVICE, MINE SYSTEM	0.2	0.1	0.0
	GROUND IMP MINE SCAT SYS AT M75 (MYP)	5.0	0.0	0.0
	CANISTER MINE (VOLCANO) PRACTICE M88	2.4	0.0	1.6
	CANISTER MINE (VOLCANO) XM87	54.6	81.0	78.5
	MINE, CLEARING CHARGE, ALL TYPES	45.2	23.6	1.6
	MODULAR PACK MINE SYSTEM	33.1	0.0	0.0
	DEMOLITION MUNITIONS & OTHER	14.4	5.0	5.6
	RANGER, ANTI-ARMOR WPN SYS (SOF)	0.0	3.7	0.0
	LIGHTWEIGHT MULTI-PURPOSE WEAPON	71.6	70.0	16.6
	LIGHT WGT MULTI-PURPOSE SYSTEM TRNR	3.3	0.0	0.0
	ROCKET, HYDRA 70, ALL TYPES	52.9	80.6	43.5
	CTG, 165MM, COMB ENG VEH, 7P	0.0	8.1	0.0
	LINEAR SHAPED CHARGE	2.8	0.0	0.0
	GRENADE, HAND, ALL TYPES	7.8	12.6	8.0
	SIGNALS, ALL TYPES	3.5	5.0	2.7
	SIMULATORS, ALL TYPES	6.1	5.3	10.2
	MISCELLANEOUS			
	AMMO COMPONENTS/SUPPORT, ALL TYPES	26.2	29.9	27.8
	CAD/PAD	6.8	7.2	8.1
	ITEMS LESS THAN $2.0M (MISC-AMMO)	5.1	4.4	4.2
	EOD EXPLOSIVE ITEMS	0.0	2.3	1.1
	SPARES AND REPAIR PARTS	2.5	8.9	0.0
	AMMUNITION PECULIAR EQUIPMENT	10.8	7.1	6.0
	NITROGUANIDINE (LB)	15.8	22.8	28.8
	AMMO 9WW/ELT	2.8	2.0	0.0
	HOST NATION SUPPORT	29.1	18.2	18.6
	CLASSIFIED & OTHER	45.5	182.1	214.3

FY91 PROCUREMENT AMMUNITION, ARMY(cont)

SSN	NOMENCLATURE	FY89	FY90	FY91
	AMMUNITION PRODUCTION BASE SUPPORT			
	PRODUCTION BASE SUPPORT			
	PROVISION OF INDUSTRIAL FACILITIES	173.6	233.3	134.6
	COMPONENTS FOR PROVE-OUT	12.3	4.0	12.1
	LAYAWAY OF INDUSTRIAL FACILITIES	19.6	28.0	40.6
	RDX FACILITY	72.3	0.0	0.0
	JEFFERSON PROVING GRD MODERNIZATION	1.0	2.0	4.0
	MAINTENANCE OF INACTIVE BASE	0.0	64.6	67.6
	TOTAL AMMUNITION PROCUREMENT, ARMY	2020.3	1909.0	1424.4

FY91 OTHER PROCUREMENT, ARMY

SSN	NOMENCLATURE	FY89	FY90	FY91
	TACTICAL AND SUPPORT VEHICLES			
	TACTICAL VEHICLES			
	TACTICAL TRAILERS/DOLLY SETS	23.4	16.0	6.6
	SEMITRAILER BB/CONT 22 1/2T M871 C/S	25.7	0.0	16.1
	SEMITRAILER, LOW BED, 40T M870 (C/S)	6.6	0.0	0.0
	SEMITRAILER, TANK, 5000G	21.4	1.2	0.0
	SEMITRAILER, TANK, 7500G, BULKHAUL	8.4	0.0	0.0
	SEMITRAILER,VAN ELEC 6T 2W M373A2	4.9	0.0	0.0
	FMTV	0.0	0.0	56.3
	HI MOB MULT-PUR WHL VEH(HMMWV)(MYP)	152.5	217.5	252.3
	SMALL UNIT SUPPORT VEHICLE (SUSV)	8.8	26.2	27.0
	TRUCK, 5T, 6X6, ABT (MYP)	223.7	0.0	0.0
	HEAVY EQUIP TRANSPORTER	0.0	25.6	100.7
	TRUCK, 10T, 8X8, ABT (MYP)	240.2	0.0	0.0
	FHTV	0.0	43.3	150.6
	TRUCK, TRACTOR, LINE HAUL, M915AI	23.1	9.7	0.0
	MODIFICATION OF IN SERVICE EQUIPMENT	5.4	3.1	4.7
	ITEMS LESS THAN $2.0M (TAC VEH)	3.5	3.5	1.6
	NON-TACTICAL VEHICLES			
	PASSENGER CARRYING VEHICLES	3.4	2.0	5.6
	GENERAL PURPOSE VEHICLES	3.4	5.0	7.9
	TRUCK, CARGO, PICKUP, 4X2	0.8	0.0	0.0
	TRUCK, CARRYALL	2.1	0.0	0.0
	SPECIAL PURPOSE VEHICLES	9.1	7.7	7.5
	SUPPORT EQUIPMENT AND FACILITIES			
	TOTAL PACKAGE FIELDING	0.0	0.0	9.3
	FIRST DESTINATION TRANSPORTATION	0.0	0.0	9.3
	SPARES AND REPAIR PARTS (TAC)	42.7	41.0	0.0
	PRODUCTION BASE SUPPORT (TAC)	1.0	1.4	1.0

FY91 OTHER PROCUREMENT, ARMY(cont)

SSN	NOMENCLATURE	FY89	FY90	FY91
	COMMUNICATIONS AND ELECTRONICS			
	COMM - JOINT COMMUNICATIONS			
	CLASSIFIED PROJECT 9WW	22.4	8.5	0.0
	JCSE EQUIPMENT	3.1	2.4	4.5
	TRACTOR SEAT	0.0	0.6	0.0
	COMM - SATELLITE COMMUNICATIONS			
	DEFENSE SATELLITE COMM SYSTEM	60.5	28.8	40.3
	GMF CONTROL	0.0	0.0	1.1
	NAVSTAR USER EQUIPMENT	14.0	17.0	29.4
	SINGLE CHANNEL OBJECT TACT TERM	36.5	0.0	0.0
	MOD OF IN-SVC EQUIP (TAC SAT)	4.5	2.6	9.9
	SAT TERM, MPK UHF, AN/PSC-3	1.3	0.0	0.0
	SAT TERM, VEH UHF, AN/VSC-7	0.6	0.0	0.0
	COMM - C3 SYSTEMS			
	EUCOM COMMAND CENTERS	0.0	5.4	7.4
	EUSA-C3I INITIATIVES	12.1	7.2	4.4
	SECURE CONFERENCING PROJECT	0.0	2.2	1.2
	SOUTHCOM C3 UPGRADE	0.0	0.0	1.1
	USAREUR TACTICAL C2 SYSTEMS	6.5	5.1	6.0
	WWMCCS INFORMATION SYSTEM (WIS)	15.2	27.4	20.9
	COMM - COMBAT COMMUNICATIONS			
	ARMY DATA DISTRIBUTION SYS (ADDS)	70.8	0.0	22.2
	MOBILE SUBSCRIBER EQUIP (MSE)	991.1	934.7	29.3
	SINCGARS FAMILY	237.5	100.0	311.3
	SMALL UNIT TRANSCEIVER	4.7	4.0	0.0
	SOF COMMUNICATION	115.5	34.2	0.0
	SWASIA COMM INFRASTRUCTURE	17.0	17.1	0.0
	EAC COMMUNICATIONS	112.8	2.0	24.8
	MOD OF IN-SVC EQUIP (EAC COMM)	23.0	0.0	37.7
	VEHICULAR INTERCOM SYSTEM	10.0	0.0	0.0
	MOD OF IN-SVC EQUIP (CMBT COMM)	0.5	4.2	0.0
	ITEMS LESS THAN $2.0M (CMBT COMM)	2.6	0.2	0.0
	COMM - COMMUNICATIONS SECURITY			
	TSEC - IFF COMSEC	8.2	0.0	0.0
	TSEC - TRUNK ENCRYPTION DEVICES	6.2	10.0	5.3
	TSEC/KG-84, DED LOOP ENCRYP DEV	7.4	11.4	11.3
	TSEC/KGV-11, SECURE MODULE	2.1	1.2	0.0
	TSEC/KGV-13, COMSEC MODULE	2.1	0.0	0.0
	TSEC/KGV-10, FREQUENCY MODULE	5.7	0.0	0.0

FY91 OTHER PROCUREMENT, ARMY(cont)

SSN NOMENCLATURE	FY89	FY90	FY91
TSEC/KGX-93, AUTO KEY DC	0.6	0.0	0.0
TSEC/KY-99, MINTERM	0.0	6.2	5.0
ITEMS LESS THAN $2.0M (COMSEC)	3.3	6.0	6.4
SOF ITEMS LESS THAN $2.0M (COMSEC)	0.2	0.0	0.0
TSEC - SEC VOICE IMPROV PROG	20.7	1.5	1.8
COMM - LONG HAUL COMMUNICATIONS			
TERRESTRIAL TRANSMISSION	0.0	5.5	5.9
C-E FACILITIES/PROJECTS	2.3	2.1	2.4
DEFENSE DATA NETWORK	0.0	0.6	2.7
ELECTROMAG COMP PROG	0.0	0.5	0.4
WW TECH CON IMPROV PROG	0.0	3.0	4.2
COMM - BASE COMMUNICATIONS			
INFORMATION SYSTEMS	73.6	37.6	39.7
AR TELECOM AUTO PROG	3.9	3.1	2.6
LOCAL AREA NETWORK	0.4	0.5	4.0
PENTAGON TELECOM CENTER	0.0	1.2	3.5
ELECT EQUIP - CLASSIFIED INTELLIGENCE AND RELATED PROGRAMS			
INTELLIGENCE & RELATED PROGRAMS	147.2	170.4	132.5
ELECT EQUIP - ELECTRONIC WARFARE			
TACTICAL DECEPTION	5.2	1.5	0.5
MOD OF IN-SVC EQUIP (EW)	10.8	8.4	0.0
ITEMS LESS THAN $2.0M (EW)	2.3	0.0	0.0
ELECT EQUIP - TACTICAL SURVEILLANCE			
NON-IMAGING ID SYSTEMS	0.0	1.0	0.0
TRACTOR CRASH	0.0	14.6	2.1
NIGHT VISION DEVICES	156.2	61.7	62.2
PHYSICAL SECURITY SYSTEMS	25.9	18.4	11.8
RADIATION MONITORING SYSTEMS	9.2	15.4	18.8
LT WT ARTILLERY METEOROLOGICAL SYS	4.0	0.0	0.0
POSITION AZIMUTH DETERMINING SYS	15.4	0.0	0.0
POWER SUPPLY, PP-6224	3.2	0.0	0.0
ELECTRONIC MAINTENANCE SHOPS	3.7	0.0	0.0
MOD OF IN-SVC EQUIP (TAC SURV)	25.7	11.2	16.6
ITEMS LESS THAN $2.0M (TAC SURV)	5.9	1.6	0.0
ELECT EQUIP - TACTICAL C2 SYSTEMS			
CMBT SVC SPT CONTROL SYS (CSSCS)	0.0	1.0	0.0
CORPS/THEATER ADP SVC CTR (CTASC)	12.8	17.7	13.2
FORWARD ENTRY DEVICE	4.5	24.6	19.7
LIGHT TACTICAL FIRE	13.2	0.0	0.0

FY91 OTHER PROCUREMENT, ARMY(cont)

SSN	NOMENCLATURE	FY89	FY90	FY91
	LIFE CYCLE SOFTWARE SPT (LCSS)	9.2	0.5	0.5
	LOGTECH	.4	8.0	8.3
	MANEUVER CONTROL SYS (MCS)	9.6	13.9	0.0
	TACT ARMY CSS COMPUTER SYS (TACCS)	23.5	24.9	15.7
	ELECT EQUIP - AUTOMATION			
	AUTOMATED DATA PROCESSING EQUIP	96.7	54.8	64.8
	RESERVE COMPONENT AUTO SYS (RCAS)	34.6	0.0	0.0
	ELECT EQUIP - AUDIO VISUAL SYSTEMS			
	AFRTS	5.2	5.9	6.6
	TACT ELEC NEWS GATHERING EQUIP	2.0	0.0	0.0
	ITEMS LESS THAN $2M (A/V)	4.8	2.0	2.1
	ELECT EQUIP - TMDE			
	CALIBRATION SETS	21.8	8.6	13.6
	CORE ELECT AUTO TEST (STE-X)	0.0	2.0	0.0
	INTEGRATED FAMILY OF TEST EQUIP	37.5	39.7	33.6
	TMDE FOR STE/ICE	1.8	0.0	0.0
	TMDE MODERNIZATION	16.7	21.8	18.6
	ELECT EQUIP - SUPPORT			
	SPARE & REPAIR PARTS (OPA2)	319.5	253.1	0.0
	ARMY PRINTING & BINDING	0.0	3.0	3.6
	PECIP AND QRIP	7.4	14.7	15.6
	PRODUCTION BASE SUPPORT	6.7	9.6	12.7
	FIRST DESTINATION TRANS (C-E)	0.0	0.0	41.5
	SPECIAL PROGRAMS	77.1	47.4	139.7
	OTHER SUPPORT EQUIPMENT			
	CHEMICAL DEFENSIVE EQUIPMENT			
	DECONTAMINATE APP PWR DR LT WT XM17	4.8	0.0	7.1
	MASK, PROTECTIVE, NBC	1.5	57.0	5.0
	MASK, ACFT	0.0	9.9	23.3
	CHEMICAL AGENT MONITOR	0.0	12.0	20.2
	SIMP COLL PROT EQUIP XM20	5.1	6.2	2.5
	COLL PROT EQUIP, NBC TEMPER	0.0	0.0	4.4
	RECON SYSTEM, NBC	0.0	26.0	36.9
	BRIDGING EQUIPMENT			
	ITEMS LESS THAN $2.0M (BRIDGING)	2.0	0.8	0.6

FY91 OTHER PROCUREMENT, ARMY(cont)

SSN	NOMENCLATURE	FY89	FY90	FY91
	ENGINEER (NON-CONSTRUCTION) EQUIPMENT			
	DISPENSER MINE XM139	5.0	8.9	5.6
	MARKING SYS, CLEAR LANE	1.4	0.0	0.0
	DETECTING SET, MINE, AN/PSS-12	2.4	0.0	0.0
	MINE PLOW (BLADE)	8.5	0.0	0.0
	MINE CLEARING ROLLER	2.6	0.0	0.0
	VEHICLE MAGNETIC SIGN DUP	0.0	0.0	4.6
	M-9 ARMORED CMBT EARTHMOVER(ACE)(MYP)	61.3	61.5	59.9
	ITEMS LESS THAN $2.0M (ENG NON-CONST)	1.5	0.0	0.0
	MOD IN-SVC EQ (ENGR-NC)	0.0	0.0	1.9
	COMBAT SERVICE SUPPORT EQUIPMENT			
	AIR COND VARIOUS SIZE/CAPACITIES	1.6	6.9	3.0
	FIELD KITCHEN, MOBILE, TRL MTD	15.3	10.0	6.6
	RIGID WALL SHELTER CMD POST ANNEX	0.0	4.8	11.4
	DIVING EQUIPMENT	1.4	2.0	0.0
	FIRETRUCKS	8.1	0.0	0.0
	SPACE HEATER	2.0	0.0	0.0
	LAUNDRY UNIT/TRL MTD	1.2	0.0	4.9
	ARMY PRINTING AND BINDING EQUIPMENT	2.6	0.0	0.0
	ITEMS LESS THAN $2.OM (CCS-EQ)	5.4	5.3	3.4
	MOD OF IN SVC EQUIPMENT (CSE)	1.2	0.8	0.0
	SOF ITEMS LESS THAN $2.0M	0.0	0.7	0.0
	PETROLEUM EQUIPMENT			
	TANK ASSEMBLY FAB COLL POS 5000OG	3.7	2.3	1.0
	TANK ASSEMBLY FAB COLLAPSIBLE IOK G	4.4	1.1	1.1
	TANK ASSEMBLY FAB COLL, 20K GAL POL	0.0	0.0	3.3
	TANK/PUMP UNIT LIQ DISP F/TRK MNT	5.1	3.0	0.0
	LAB, PETROLEUM, SEMI-TRLR MTO	1.6	1.5	3.8
	PUMP ASBLY LIQ GAS WHL 4 IN OUT 350GP	0.0	0.0	4.5
	SWA PETROLEUM DISTRIBUTION	39.1	25.0	56.2
	ITEMS LESS THAN $2.OM (POL)	3.6	1.5	2.0
	WATER EQUIPMENT			
	WTR PUR UNIT REV OS 3000 GPH (ROWPU)	5.4	0.0	14.3
	TANK, FAB,COLL,3K GAL WATER (ONION)	2.4	1.1	1.0
	WATER QUALITY ANALYSIS SET PURIF	0.0	0.0	1.0
	ITEMS LESS THAN $2.0M (WATER EQ)	2.6	3.0	2.6
	MEDICAL EQUIPMENT			
	COMBAT SUPPORT MEDICAL	102.6	56.3	60.3
	MEDICAL SUPPORT EQUIPMENT	59.3	58.6	72.4
	MAINTENANCE EQUIPMENT			
	WELDING SHOP, TRAILER MTD	4.0	0.6	0.0
	SHOP EQ ELECTRICAL RPR SEMI-TRL MTD	0.4	0.0	0.0
	ITEMS LESS THAN $2.0M (MAINT EQ)	1.3	11.3	7.7

FY91 OTHER PROCUREMENT, ARMY(cont)

SSN	NOMENCLATURE	FY89	FY90	FY9
	CONSTRUCTION EQUIPMENT			
	SMALL EMPLACEMENT EXCAVATOR (SEE)	32.9	0.0	1.5
	MODS OF IN SVC EQUIP (CONST EQUIP)	0.1	2.0	0.0
	ITEMS LESS THAN $2.0M (CONST EQUIP)	10.4	3.1	3.4
	RAIL FLOAT CONTAINERIZATION EQUIPMENT			
	LANDING, CRAFT, UTILITY	52.3	0.0	0.0
	TUG INLAND & COAST WATERWAYS	7.5	0.0	0.0
	CAUSEWAY SYSTEMS0.4	0.0	0.0	
	MOD IN-SERVICE EQ (FLOAT/RAIL)	3.3	1.7	3.6
	ITEMS LESS THAN $2.0M (FLOAT/RAIL)	6.8	.1	2.3
	GENERATORS			
	GENERATORS AND ASSOC EQUIP	35.3	21.9	45.8
	MATERIEL HANDLING EQUIPMENT			
	TRUCK, FORKLIFT, DE, PT, RT 6K LB	21.9	21.3	20.0
	TRUCK, FORKLIFT, DE, PT, RT 4K LB	0.0	14.1	18.2
	65 TON CRANE	3.4	0.0	0.0
	ITEM LESS THAN $2.0M (HME)	2.0	.1	4.6
	OTHER SUPPORT EQUIPMENT			
	TOTAL PACKAGE FIELDING	0.0	0.0	10.8
	FIRST DESTINATION TRANSPORTATION	0.0	0.0	10.7
	SPARES AND REPAIR PARTS	31.4	26.6	0.0
	BASE LEVEL COML EQUIPMENT	0.0	22.7	16.3
	PROD ENHANCING CAPITAL INVEST PROG	0.0	4.9	4.9
	QUICK RETURN ON INVESTMENT PROGRAM	0.0	2.6	2.6
	NON-CENTRALLY MANAGED ITEMS	21.6	0.0	0.0
	PRODUCTION BASE SUPPORT (OTH)	14.0	15.3	10.6
	OSD PRODUCTIVITY INVESTMENT FUNDING	10.0	20.2	34.3
	INDUSTRIAL MODERNIZATION INCENTIVE PROGRAM	0.0	9.0	3.5
	SPECIAL EQUIPMENT FOR USER TESTING	14.7	18.1	12.7
	HOST NATION SUPPORT-EUROPE	57.4	122.3	0.0
	COMBAT TRAINING CENTERS SUPPORT	23.1	30.9	15.8
	PREPOSITIONED NTC EQUIP	0.0	33.7	0.0
	TRAINING DEVICES, NON-SYSTEM	98.8	123.8	101.4
	INSTALLATION OF MODERNIZATION EQUIPMENT	0.0	81.4	0.0
	SIMNET/CLOSE COMBAT TACTICAL TRAINER	15.0	0.0	0.0
	AREA ORIENTED DEPOT UPGRADE	4.0	30.5	30.5
	IND/DEPOT MAINT EQUIP	0.0	58.9	82.4
	TOTAL OTHER PROCUREMENT, ARMY	**4658.1**	**3608.3**	**2827.5**

FY91 RESEARCH, DEVELOPMENT, TEST & EVAL, ARMY

SSN	NOMENCLATURE	FY89	FY90	FY91
	TECHNOLOGY BASE			
	IN-HOUSE LAB INDEPENDENT RESEARCH	0.0	8.9	9.4
	DEFENSE RESEARCH SCIENCES	170.9	172.6	179.5
	MATERIALS	10.6	10.8	13.3
	ELEC SURVIVABILITY AND FUZING TECHNOLOGY	39.1	26.6	24.9
	AVIATION TECHNOLOGY	42.6	40.6	41.9
	MISSILE TECHNOLOGY	23.6	30.1	27.2
	LASER WEAPON TECHNOLOGY	6.2	0.5	0.6
	TANK AND AUTOMOTIVE TECHNOLOGY	22.0	32.1	36.1
	BALLISTICS TECHNOLOGY	30.6	26.6	27.7
	CHEMICAL AND SMOKE MUNITIONS	39.4	52.8	50.8
	JOINT SERVICE SMALL ARMS PROGRAM	13.1	5.1	5.4
	WEAPONS AND MUNITIONS TECHNOLOGY	34.7	36.0	36.9
	ELECTRONICS AND ELECTRONIC DEVICE	21.5	17.3	17.6
	NIGHT VISION INVESTIGATIONS	22.0	18.8	19.3
	HUMAN FACTOR ENGR TECHNOLOGY	18.1	8.2	8.0
	ENVIRONMENTAL QUALITY HEALTH	9.8	11.7	9.8
	NON-SYSTEM TRAINING DEVICES	3.6	3.5	3.6
	C3 TECHNOLOGY	16.4	15.6	20.5
	COMPUTER & SOFTWARE TECHNOLOGY	6.2	3.5	5.1
	MILITARY ENGINEERING TECHNOLOGY	43.0	43.8	46.1
	MANPOWER/PERSONNEL/TRAINING TECHNOLOGY	17.4	16.8	17.3
	LOGISTICS TECHNOLOGY	41.3	35.5	35.8
	MEDICAL TECHNOLOGY	104.4	94.4	96.9
	OTHER TECH BASE PROGRAMS	5.6	17.6	35.1
	ADVANCED TECHNOLOGY DEVELOPMENT			
	ADVANCED SOF RDA	14.2	12.2	0.0
	LOGISTICS ADVANCED TECHNOLOGY	10.4	10.3	9.1
	MEDICAL ADVANCED TECHNOLOGY	31.7	34.2	34.8
	AVIATION ADVANCED TECHNOLOGY	31.9	31.5	34.7
	WEAPONS AND MUNITIONS ADVANCED TECHNOLOGY	77.7	76.6	33.5
	COMBAT VEH & AUTO ADV TECHNOLOGY	61.8	119.3	176.8
	C3 ADV TECHNOLOGY	6.9	7.9	9.3
	HUMAN FACTORS/PSNL/TNG	29.0	18.6	19.0
	TRACTOR HOLE	0.0	11.4	4.7
	TRACTOR DIRT	0.0	1.8	1.2
	MATERIALS AND STRUCTURES	7.4	4.6	5.0
	ACQUIRED IMMUNE DEFICIENCY RESEARCH	26.7	33.5	22.6
	MSL/ROCKET COMPONENTS	13.4	10.5	8.8
	HIGH ENERGY LASER & DIRECTED ENERGY	5.7	45.5	41.0
	ATCCS EXPER SITE (AES)	4.9	3.9	0.0
	LANDMINE WARFARE/BARRIER DEVELOPMENT	8.9	10.1	11.8

FY91 RESEARCH, DEVELOPMENT, TEST EVAL. ARMY(cont)

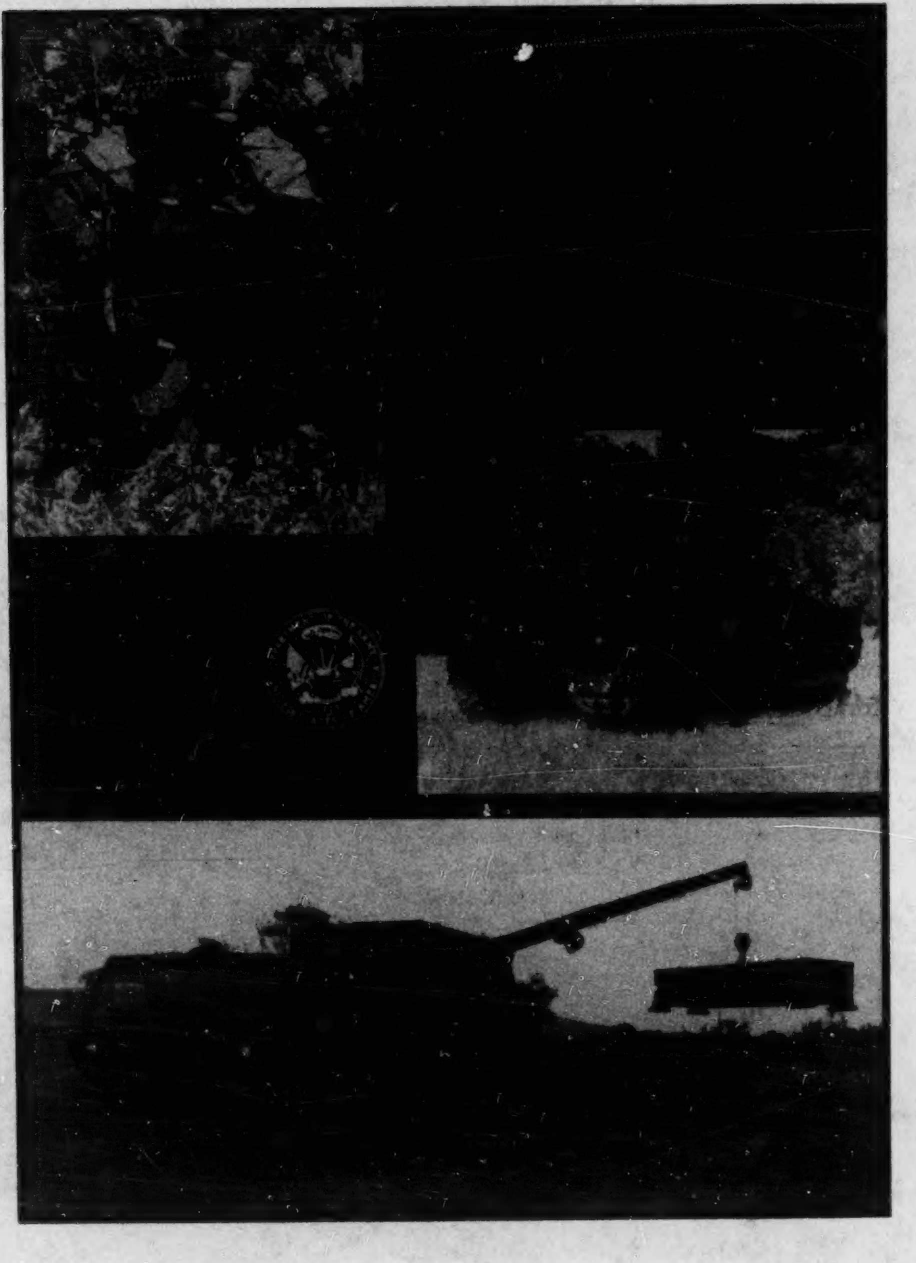
SSN	NOMENCLATURE	FY89	FY90	FY91
	JOINT SERVICE SMALL ARMS PROGRAM	9.4	6.7	5.4
	NIGHT VISION ADVANCED DEVELOPMENT	18.5	21.5	20.3
	ENVIRONMENTAL QC EQUIPMENT	7.3	0.0	0.0
	ENGINEERING SYSTEMS	2.3	3.6	2.4
	ADV ELECTRONIC DEVICES DEVELOPMENT	6.2	7.7	5.6
	ARMY BATTLEFIELD TECH INTEGRATION	11.2	0.0	0.0
	CB DEF/SMK ADV TECH DEMOS	2.8	3.9	4.1
	ADV TACTICAL COMPUTER SCIENCE & TECHNOLOGY	4.5	4.4	4.8
	OTHER ADV TECH DEV PROGRAMS	36.7	34.8	30.1
	STRATEGIC PROGRAMS			
	TOTAL STRATEGIC PROGRAMS	70.2	186.3	296.1
	TACTICAL PROGRAMS			
	ADV ANTI-TANK WEAPON SYS(MEDIUM)	37.4	55.7	22.0
	LANDMINE/BARRIER SYSTEM	13.6	0.7	3.0
	SMOKE MUNITIONS & MATERIEL CONCEPTS	6.6	8.7	12.4
	MSAM	0.0	0.0	6.9
	IDENT FRIEND OR FOE DEVELOPMENT	16.6	0.0	1.0
	ARMY DATA DISTRIBUTION SYSTEM	19.6	19.1	21.7
	SOLDIER SUPPORT/SURVIVABILITY	5.2	6.7	7.5
	FORWARD AREA AIR DEFENSE SYSTEMS	94.5	54.8	0.0
	NIGHT VISION SYS ADVANCED DEVELOPMENT	3.8	3.0	3.3
	LONGBOW AD	85.6	22.8	0.0
	FOLLOW-ON LANCE-ADV DEV	7.4	0.0	0.0
	AVIATION ADVANCED DEVELOPMENT	4.9	15.7	5.1
	WEAPONS & MUNITIONS ADV DEV	21.9	17.6	18.6
	CHEMICAL SYSTEMS ADV DEV	0.0	7.1	4.5
	LOG & ENGR EQUIPMENT ADV DEV	15.9	16.5	13.5
	CSS COMPUTER SYSTEM EVAL/ANALYSIS	4.8	2.2	11.2
	CHEM/BIO DEFENSE EQUIP ADV DEV	9.8	19.7	24.5
	MEDICAL SYSTEMS ADV DEV	30.6	26.9	28.8
	AIRCRAFT WEAPONS	7.1	9.5	7.6
	AIRCRAFT PROPULSION SYSTEM	50.8	50.9	53.7
	LIGHT ARMED SCOUT HELICOPTER	126.4	223.3	411.4
	HELIBORNE MISSILE - HELLFIRE	3.0	0.0	0.0
	GRASS BLADE	4.6	0.0	0.0
	ARMY TACTICAL MISSLE SYSTEM-ARMY	73.6	41.0	0.0
	MED TAC VEH	24.8	18.1	7.0
	SMOKE MUNITIONS AND MATERIEL	5.7	13.0	10.3
	ADVANCED ANTI-TANK WPN SYS-ED	105.2	137.9	76.8
	FAMILY OF HVY TACTICAL VEHICLES	28.0	5.3	0.0
	ADVANCED TANK CANNON (ATAC)	0.0	0.0	46.3
	ID FRIEND OR FOE EQUIP DEV	21.1	22.8	13.9
	NIGHT VISION DEVICES	16.4	19.1	17.7
	COMBAT FEEDING, CLOTHING AND EQUIP	2.4	22.6	4.4
	NONSYSTEM TRAINING DEVICES ENGINEERING	22.2	15.8	32.4
	SPECIAL PURPOSE DETECTORS	0.5	0.5	0.5

FY91 RESEARCH, DEVELOPMENT, TEST EVAL, ARMY(cont)

SSN	NOMENCLATURE	FY89	FY90	FY91
	AIR DEFENSE COMMAND, CONTROL & INTEL	87.5	49.1	86.7
	AUTOMATIC TEST EQUIPMENT DEVELOPMENT	7.8	9.1	8.3
	EDUC/TRNG SYS DEVELOPMENT	6.8	0.0	0.0
	JT CB POC/TEST/ASSESS	5.6	5.9	6.3
	OTHER TACTICAL PROGRAMS	709.0	578.9	598.7
	ARMED AHIP	0.0	0.0	25.8
	TRACTOR FLY	0.0	28.7	17.2
	ADVANCED MISSILE SYS-H	10.7	12.8	1.0
	JT INTEROP OF TAC CMD & CONT SYS	9.4	4.3	0.0
	AVIATION ENG DEV	8.5	15.7	19.4
	WEAPONS & MUNITIONS ENGNRNG DEV	11.8	22.5	11.1
	CHEMICAL SYSTEMS ED	33.3	31.0	27.8
	LOG & ENGR EQUIP ED	12.7	31.1	27.5
	C3 ED	12.6	11.7	1.4
	CHEM/BIO DEFENSE EQUIP ED	11.8	39.0	57.3
	MEDICAL MATERIEL/MEDICAL BIO DEF ED	17.3	17.3	19.6
	LANDMINE WARFARE/BARRIER EQUIP ED	16.0	9.7	17.4
	FOG-M ENG DEV	96.4	122.1	99.1
	TRACTOR PULL	0.0	3.9	35.2
	SADARM ENG DEV	143.9	142.8	105.5
	TRACTOR TRAILER	0.0	4.9	0.0
	LONGBOW ED	0.0	73.4	159.1
	TRACTOR, BALL	19.7	9.5	2.5
	ARMY TAC C3I	8.0	24.9	22.8
	LOSAT	0.0	0.0	72.9
	RADAR DEVELOPMENT	0.0	16.9	0.0
	FOLLOW-ON LANCE	0.0	32.3	112.2
	ADV FIELD ARTILLERY TACT DATA SYS	17.0	32.0	45.8
	COMBAT VEHICLE IMPROVEMENT PGM	136.1	62.2	97.8
	AIR DEFENSE C2I MOD	5.3	0.0	0.0
	MANEUVER CONTROL SYSTEM	11.9	7.3	25.5
	155MM SELF-PROPELLED HOWITZER IMPROV	28.4	10.5	8.8
	AIRCRAFT MODIFICATIONS/PIP	73.6	66.5	60.5
	EQUIPMENT UPGRADE	20.9	0.0	0.0
	SPECIAL OPERATIONS FORCES EQUIPMENT	118.1	52.7	0.0
	AIRCRAFT ENGINE COMPONENT IMPROVEMENT	7.9	5.7	7.1
	MISSILE/AIR DEFENSE PIP	33.4	48.6	40.8
	OTHER MISSILE PRODUCT IMPROVE PGM	39.5	79.4	73.3
	TRACTOR RIG	0.0	9.8	23.0
	TRACTOR CARD	11.0	11.8	7.4
	DRAGON III	5.2	0.0	0.0
	TACIT RAINBOW	0.0	47.0	105.3
	JOINT TACTICAL COMMO PROGRAM (TRITAC)	13.7	0.0	6.1
	EUCOM C3 SYSTEMS	1.0	0.0	0.0
	LANDMINE WARFARE	0.0	21.5	34.7
	CLASSIFIED PROGRAM	0.0	0.0	13.4
	JT TAC MSL DEF	34.9	45.4	62.2
	SURF TO SURF MSL RKT	35.3	28.4	47.2

FY91 RESEARCH, DEVELOPMENT, TEST & EVAL, ARMY(cont)

SSN	NOMENCLATURE	FY89	FY90	FY91
	INTELLIGENCE AND COMMUNICATIONS			
	NAVSTAR GLOBAL POSITIONING SYSTEM	8.6	7.6	6.4
	SATCOM GROUND ENVIRONMENT	24.7	54.6	47.7
	OTHER IEW	20.7	38.4	41.3
	DEFENSEWIDE MISSION SUPPORT			
	KWAJALEIN MISSLE RANGE	157.5	162.9	180.0
	ARMY TEST RANGES AND FACILITIES	190.1	214.9	229.9
	ARMY TECH TEST INSTRU & TARGETS	57.9	60.5	88.5
	ARMY USER TEST INSTRU AND THREAT SIMU	39.6	46.3	41.2
	MET SUPT TO RDTE ACTIVITIES	18.4	23.1	24.4
	TECH/VULN ASSESSMENT	25.7	33.4	36.0
	MATERIEL SYSTEMS ANALYSIS	24.4	23.0	23.4
	SUPPORT OF OPERATIONAL TESTING	50.5	63.2	63.3
	PROGRAM WIDE ACTIVITIES	83.6	84.2	93.2
	INTL COOPERATIVE RESEARCH AND DEV	1.1	1.7	1.9
	TECHNICAL INFO ACTIVITIES	5.8	5.9	7.7
	MUN STANDTRD EFFECTIVENESS & SAFETY	16.8	12.5	12.8
	RDTE SUPP FOR NON-DEVELOP ITEMS	18.5	7.4	7.6
	PRODUCTIVITY INVESTMENTS	48.9	18.9	19.2
	REAL PROPERTY MAINTENANCE (RDT&E)	164.9	199.2	222.8
	BASE OPERATIONS (RDT&E)	183.1	191.5	204.4
	MGT HQ (RESEARCH/DEVELOPMENT)	11.1	14.5	15.3
	INDUSTRIAL PREPAREDNESS	19.8	24.6	26.7
	OTHER DEF MSN SPT	50.1	16.9	22.7
	TOTAL RESEARCH DEVELOPMENT TEST & EVAL, ARMY	5154.2	5418.7	6025.9



THURSDAY, MARCH 22, 1990.

RESEARCH, DEVELOPMENT, TEST AND EVALUATION, NAVY

WITNESSES

GERALD A. CANN, ASSISTANT SECRETARY OF THE NAVY, RESEARCH, DEVELOPMENT AND ACQUISITION

VICE ADMIRAL PETER M. HEKMAN, JR., USN, COMMANDER, NAVAL SEA SYSTEMS COMMAND

VICE ADMIRAL RICHARD C. GENTZ, USN, COMMANDER, NAVAL AIR SYSTEMS COMMAND

REAR ADMIRAL J. GUY REYNOLDS, USN, DIRECTOR, NAVY REQUIREMENTS FOR RESEARCH AND DEVELOPMENT, TEST AND EVALUATION

INTRODUCTION

Mr. MURTHA. The committee will come to order.

This morning the committee will hear testimony on the research, development, test and evaluation, Navy appropriation, for which $9.5 billion is requested for fiscal year 1991. The committee is pleased to welcome Mr. Gerald A. Cann, who less than two weeks ago, was sworn in as the Navy's first Assistant Secretary of the Navy for Research, Development and Acquisition.

The new position is meant to consolidate and improve acquisition management in the Navy. Mr. Cann is accompanied by a number of Commanders from Naval Systems Commands.

Today's hearing is closed due to the classification of the material.

We want to welcome you to your first hearing in this capacity before us, Mr. Secretary, and your full statement will go in the record. If you will summarize we will get right to the questions.

SUMMARY STATEMENT OF MR. CANN

Mr. CANN. Thank you very much, Mr. Chairman and members of the committee. It is a great honor to be back.

I should point out it has been five years since I was before this committee and in a different position at the time.

As you know, I was sworn in on the 12th of the month and at the time I was sworn in, the Secretary of the Navy signed out the instruction which set up the new acquisition structure within the Navy. We are beginning to undertake the reorganization mandated by the Defense Management Review.

I am here today to discuss with you whatever issues you would like to discuss relative to the R&D program. I brought with me the three SYSCOM Commanders, Admiral Peter Hekman, Admiral John Weaver, and Admiral Richard Gentz. In addition, in case there are questions regarding requirements, I have brought Admiral Guy Reynolds with me to answer those questions. I would like to point out that the Navy Acquisition Executive does not generally get into the subject of requirements.

I did not bring anyone from the Marine Corps, because you had a hearing last week on Marine Corps issues and that has been covered. If there is an issue, I would be happy to take it for the record if I can't answer it.

With that, I would like to get into questions that you would like to talk about.

[The statement of Mr. Cann follows:]

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HOUSE APPROPRIATIONS COMMITTEE
DEFENSE SUBCOMMITTEE

STATEMENT OF

GERALD A. CANN

ASSISTANT SECRETARY OF THE NAVY

(RESEARCH, DEVELOPMENT AND ACQUISITION)

BEFORE THE

SUBCOMMITTEE ON DEFENSE

OF THE HOUSE APPROPRIATIONS COMMITTEE

ON THE FY-1991

NAVY RESEARCH, DEVELOPMENT, TEST AND EVALUATION PROGRAM

MARCH 22, 1990

NOT FOR PUBLICATION UNTIL
RELEASED BY THE
HOUSE APPROPRIATIONS COMMITTEE
DEFENSE SUBCOMMITTEE

GERALD A. CANN
Assistant Secretary of the Navy
for Research, Development and Acquisition

On 12 March 1990, Mr. Gerald A. Cann was sworn in as the first Assistant Secretary of the Navy for Research, Development, and Acquisition. He is responsible for all acquisition policy and procedure and all research, development, production, shipbuilding, and logistics support programs within the Department of the Navy.

Mr. Cann graduated from New York University in 1953 with a Bachelor of Science degree in Geology/Geophysics. He served two years in the US Army Signal Corps before joining the American Machine and Foundry Company where he served as TITAN I Test Manager and as Deputy Engineering Manager for the TITAN I Division.

In 1965, Mr. Cann joined TRW Systems, Inc. where he specialized in providing analyses and consulting services to the US Navy on anti-submarine warfare (ASW) systems. As a Program Manager, he conducted major aircraft reviews for the Navy on Surface Ship Sonar and other systems. He managed the Undersea Surveillance program and provided technical support to the ASW Project Office and to the Office of the Chief of Naval Operations.

In 1970, Mr. Cann joined the Office of the Secretary of Defense as Staff Assistant for Ocean Surveillance and subsequently served as the Assistant Director for Ocean Control.

In 1977, Mr. Cann was assigned to the staff of the Secretary of the Navy as the Deputy Assistant for Systems. From 1979 through 1985, Mr. Cann served as the Principal Deputy Assistant Secretary of the Navy (Research, Engineering, and Systems) where he assisted the Assistant Secretary on all matters pertaining to Navy and Marine Corps research, development, test, and evaluation.

For the next two years, Mr. Cann established a private consulting firm and provided advice on long-range planning, allocations of independent research and development funds, congressional strategy, and teaming philosophy. His firm also specialized in the technical support for anti-submarine warfare, undersea, and air defense programs. Immediately preceding his appointment as the Assistant Secretary of the Navy, Mr. Cann served as the Vice President of the Undersea Warfare Center, General Dynamics Corporation.

Mr. Cann has been active in numerous committees sponsored by both government and industry, including the Defense Science Board, Naval Research Advisory Committee, National Academy of Sciences, Chief of Naval Operations Executive Panel, and the American Defense Preparedness Association.

During his distinguished career in both government and private sectors, Mr. Cann has been recognized through the award of the Defense Meritorious Service Medal, the Navy Distinguished Civilian Service Medal, and the National Security Industrial Association Charles Weakley Award. In 1980, he was presented with the Distinguished Executive Award by the President of the United States.

PREPARED STATEMENT OF
GERALD A. CANN
ASSISTANT SECRETARY OF THE NAVY
(RESEARCH, DEVELOPMENT AND ACQUISITION)

Good morning Mr. Chairman, and distinguished members of the Subcommittee. I appreciate this opportunity to appear before you and discuss the Navy Research, Development, Test and Evaluation program. This is my first chance to appear before this subcommittee since 1985 when I was the Principal Deputy Assistant Secretary of the Navy for Research, Engineering and Systems.

I was sworn in on March 12 as the first Assistant Secretary of the Navy for Research, Development and Acquisition which was created as part of the Defense Management Review process. I would like to submit, for the record, the charter of the Assistant Secretary of the Navy for Research, Development and Acquisition. A summary of my major duties and responsibilities are:

- Serve as the Department of the Navy Acquisition Executive
- Perform as the Navy Senior Procurement Executive
- Establish acquisition policy and procedures and manage all Department of the Navy research, development, production, shipbuilding and logistics support programs
- Supervise the Program Executive Officers and direct reporting Program Managers
- Supervise the Systems Command Commanders and the Commanding General, Marine Corps Research, Development and Acquisition Command on research, development and acquisition matters
- Perform as the Department of the Navy Senior Information Resources Management Policy Official
- Develop policy for and provide management oversight of the Navy's international research, development and acquisition efforts
- Establish policy and provide oversight for all matters pertaining to technology base, advanced technology development, Navy Laboratories, and Research and Development Centers.

As shown in Figure 1, our RDT&E budget request for FY-1991 is $9,102 million. This represents a $234 million reduction from last year's projection of $9,336 million or a real decline of 7.7%. Detailed descriptions of our programs are contained in the budget justification material you have already received.

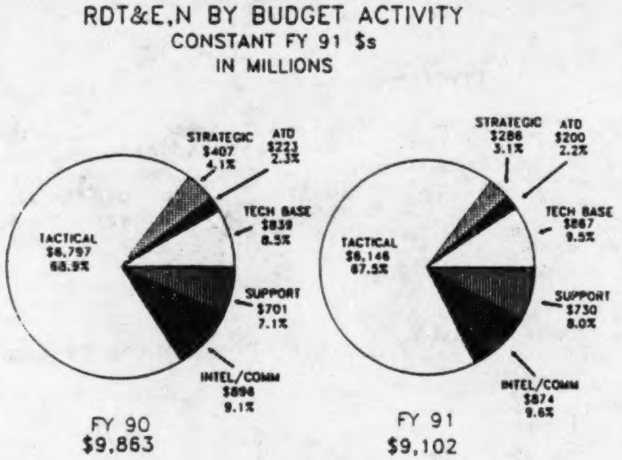
RDT&E,N BY BUDGET ACTIVITY
CONSTANT FY 91 $s
IN MILLIONS

Figure 1.

Today I have with me the Commanders of the Naval Sea, Naval Air, and Space and Naval Warfare Systems Commands. Also, to answer any requirements related questions, I have the Director, Navy Requirements for Research and Development, Test and Evaluation of the Chief of Naval Operations staff. On March 14, the Commanding General, Marine Corps Research, Development and Acquisition Command appeared before you and discussed Marine Corps procurement and RDT&E programs.

The Navy is entering a new era that will stress a streamlined acquisition process and a rededication to designing quality into our systems and into the management of our RDT&E and acquisition programs. I am extremely pleased to be leading this important effort and I look forward to working with the Congress to continually improve our research, development and acquisition programs and processes.

Since I have just recently assumed my position, I have not held detailed reviews on the submitted budget. However, I am familiar with many of the programs and will be happy to answer any questions that you might have.

CHANGES IN THE THREAT

Mr. **Murtha**. One of the problems we are wrestling with, Mr. Secretary, in this overall budget presentation, is that the threat has changed so dramatically. We recognize the fact that we are going to have to make some drastic reductions in overall defense, yet we feel very strongly that research and development is not something we can afford to cut back.

We have found over the years that research does get cut back in many cases. We recognize if we are going to cut out a program that part of the research will be cut out and I think that is something that is possible.

Have the recent events in Europe changed the way the Navy is now looking at research down the road? For instance, obviously it is going to change the role of the Army dramatically, at least in the short term. Has it changed the role of the Navy? How does this affect R&D? Do we have a different threat today or are you still working on the old threat?

Mr. **Cann**. To be frank, I haven't gotten into a lot of detail on where the threat is really going. But, I am aware of the building program that is continuing in the Soviet Union for submarines, some of their R&D activities, and some of the systems that they are fielding. With respect to the posture that is being taken relative to shifts in defense policy, it is frankly out of my purview.

Mr. **Murtha**. You say it is out of your purview?

Mr. **Cann**. I was going to go on to say that having been in the research and development business for 37 years, I am extremely sensitive to the fact that we need to maintain both a technology base and a viable research and development program because of the time it takes to make adjustments when people come up with new concepts. So, I see no trend in the Navy to reduce the emphasis on research and development for critical areas such as ASW, the Tech base, or Stealth/Counter-Stealth.

Mr. **Murtha**. I understand, and I am glad to hear that, but have you gotten any change in direction from higher echelons? For instance, we have got an entirely different world out there today. Has there been any analysis, and did it change the role of the Navy? What we are doing?

For instance, I am convinced that the threat for the Navy is in the Middle East. We are so dependent on foreign oil, to keep lines open to the U.S. Before the priority was to get troops to Europe and protect Europe. That means that research doesn't change, but the world situation has changed dramatically and you are saying to me you have got no change in mission. I am not saying you should, I am asking have you gotten any change in direction?

Mr. **Cann**. I have not received any change in direction. My view is that the direction is still to provide a strong maritime force, provide the strategic nuclear deterrent that we have and to able to project forces rapidly and with credibility while ensuring we keep the sea lines of communications open.

I don't really see a fundamental change in the Navy's mission.

SEALIFT

Mr. Murtha. You say project force rapidly, what kind of forces do you project rapidly?

Mr. Cann. The Marine Corps and lift the Army as required.

Mr. Murtha. We hear everybody saying how short we are in sealift. Are you doing research in improving sealift?

Mr. Cann. In addition to research and development, I will be responsible for all Navy acquisition.

Mr. Murtha. So in this particular case you are going to buy some ships to get people where you need them. We put money in last year for sealift. Every witness that came before the committee said we need sealift, but when it came down to it, nobody put money in for sealift. Are you advocating we need more sealift or do you have adequate sealift?

Mr. Cann. I have not has a chance to look at the sealift issue in the nine days I have been back at the Pentagon. I can't judge that.

Mr. Murtha. That is a little bit of our problem. You know how fast the threat has changed and we are trying to develop a budget which nobody is going to be happy with, and we are really kind of just looking for a direction here.

Mr. Cann. I would be happy to get back with an answer to you on a specific question on that subject. Unfortunately, I just don't have it.

Mr. Murtha. I know what you will say when you check, so you don't need to get back to us. I was hoping we would get an answer before you have a chance to check.

Mr. Cann. If I had an answer to give I would. I just don't.

REORGANIZATION

Mr. Murtha. We have had a reorganization here. Explain your acquisition reorganization and your personal goals for improving the process.

Mr. Cann. That, I can answer. At the instant that I was sworn in, the Secretary signed out an instruction which I would be glad to supply, which defines my responsibilities. Essentially it puts the Program Executive Officer's of which there are seven, plus designated direct-reporting program managers under my direct control. It incorporated the Shipbuilding and Logistics Secretariat, the Research and Engineering Secretariat and the ADP group, Information Resources Management, and it took part of the OPNAV staff from OP-098, who were the CNO's staff which dealt with research and development.

The original head count for the group was 270. Within the new secretariat group, I have a requirement to reduce that to 181 by 1 October 1990. We are in the process of redefining the Secretariat functions. I have met with all of the PEOs and SYSCOM Commanders. We are developing operating agreements outlining how the PEO structure will work, how the SYSCOMs will support the PEO structure, and also how to run the rest of the things that they have to run.

I am trying to trim the acquisition portion of the Secretariat down to a manageable and integrated operation. One observation: when I was there before, I was the Principal Deputy Assistant Secretary for Research and Development for approximately eight years, and I thought we did a reasonable job, but there was a problem between the two organizations. It was never clear who was responsible, on some occasions, for transition and so forth. I intend within 120 days, to have the Secretariat organization settled, including the reduction in people. I will have operating agreements with the SYSCOM. Commanders and agreements with the PEOs as to how we are going to operate.

Mr. Murtha. Do you have any idea of what type of manpower you are talking about?

Mr. Cann. In the secretariat I will reduce the staff from the nominal 270 to 181 by 1 October.

Mr. Murtha. Those people will come from Crystal City or the Pentagon——

Mr. Cann. They will come out of the various functions, some are in the Pentagon, some are in Crystal City.

AUTOMATED ADP PROCESSING

Mr. Murtha. I applaud you for that effort because we have been trying to come up with a method of reducing the people from the Pentagon for years that aren't needed. As you know, this committee has taken an interest in this type of streamlining so we applaud your effort.

How about ADP? Talk about that. We have been trying to get a handle on ADP management for years. How does it help to move Navy ADP under your jurisdiction?

Mr. Cann. Well, as you know, under the Defense Management Review the decision was made to move ADP into the Acquisition Executive's office and under his purview.

That is going to do a number of things once organized. It will get it into the mainstream of the decision making process for all systems, so there will not be an independent function operating relative to ADP matters. I intend to make sure that people who are dealing with ADP are well integrated into our contracting and legal organization so we have an appropriate way to deal with their contracting practices. I will also, by virtue of having line authority over them and approval authority for system developments, make sure that the policies for ADP and software, et cetera, are uniformly implemented.

What we are really doing is sort of cleaning up the act, if you will.

TECHNOLOGY BASE

Mr. Murtha. How much is requested in fiscal year 1991 for Navy technology base programs and how does this compare with last year's levels?

Mr. Cann. With respect to the Technology Base, for fiscal year 1991 we have requested $867.5 million, which represents 3.6 percent real growth. Last year, fiscal year 1990, it was about $805.6 million.

Mr. Murtha. What is your projection for the future?

Mr. **Cann**. First of all, my personal view is to maintain emphasis on science and technology and try to stabilize it, providing year-by-year real growth. I don't have a specific number at this time.

Mr. **Murtha**. You have areas of research you plan to emphasize?

Mr. **Cann**. I have a long list—a lot of which I am familiar with. I will mention a few and give you the rest for the record.

For example, in Basic Research there is a lot of work going on in parallel computer architectures, machine intelligence, robotics and neural networks. I think that is important research because the wave of the future is going to be to take complex systems and operate them with computers, thereby reducing the manning and making things work better without human intervention and without a lot of training.

I am also interested in the Exploratory Development areas that look into superconducting propulsion for applications in the future and look at ——— concepts to replace acoustic sensors for ASW practices. We have eight or ten important thrusts, but I will just mention two key ones.

[The information follows:]

Significant basic research areas: Acoustic reverberation; arctic leads, current convection and subduction; advanced infrared materials; biopolymeric materials and superconducting materials; parallel computer architectures, machine intelligence and robotics, and neural networks.

Significant exploratory development areas: Advanced submarine detection concepts/ASW weapons; advanced submarine design concepts; signature reduction and detection technologies; space-based surveillance and C3 concepts; lightweight composite materials; biotechnology with application to combat casualty care; applications of massively parallel supercomputers; superconducting propulsion and magnetic sensor concepts.

Mr. **Murtha**. All of us saw "Hunt for Red October" and we are impressed with the technology that has been developed by the Navy over the years. Mr. McDade.

STANDARD EMBEDDED COMPUTERS

Mr. **McDade**. Thank you very much, Mr. Chairman.

Welcome, Mr. Secretary. We are delighted to have you in front of the committee this morning. As you know, for a long time the committee has been in favor of the Navy plans to have families of standard signal processors and standard computers embedded in weapon systems rather than one-of-a kind stand-alone systems.

Despite its leadership in this area, the Navy often allows its individual weapon system acquisition program managers to exempt their programs from this common sense requirement in the name of short term savings. It seems to us that that is not an efficient way. What is your comment?

Mr. **Cann**. I have an extensive background in this subject, going back to 1978. I should point out that I have been in industry for five years—I have been back for nine days—it doesn't seem as though I ever left. A lot of the issues are the same. This was an issue we worked with you eight to ten years ago.

We ran a study ten years ago on the subject of standard computers and that is how the AN/UYK 43/44 programs got started. Since 1985 the Navy has used the AN/UYK-43 and AN/UYK-44 as standard computers for tactical applications.

With respect to signal processors, we have the AN/UYS-1 as the Navy's standard processor which is being used in a number of systems. The follow-on to that is the EMSP. Starting about 1993, the EMSP with SEM-E cards will be available and in use.

I should point out that there is some confusion in this world and there always will be. Adding to the confusion here, I think, is the fact that the term signal processor has more than one meaning. Machines like UYS-1 or EMSP are very powerful general purpose signal processors. There are also micro-processors that do in-place processing, pre-processing or conditioning of signals to prepare them to go into a device like an EMSP or a radar which are also referred to as signal processors, depending on who you are. There are lots of those embedded all over the place.

I might have Admiral Weaver help me out. But as we go into a more and more distributed architecture, you will see more and more kinds of miniaturized processors used.

Mr. McDade. At some point decisions have to be made. When I asked that original question, it leads to a follow-on about where their use is optional so that a project manager indeed has the option to change. What authority does the project manager have to exercise an option to exempt his program?

Mr. Cann. I don't think he has any authority to exempt it. I will check for the record.

[The information follows]

Individual program managers are constrained by directives to use Navy standard computers and signal processors for general purpose, mission critical applications unless waivers are obtained through the Commander of the Space and Naval Warfare Systems Command. In the case of signal processors, waivers must also be approved by the Secretary of the Navy. This policy was imposed to prevent proliferation of non-standard equipment.

Requests for waivers must include specific reasons why an alternative to the Navy standard is required or desired. These reasons may include things like size, power constraints, unusual environmental requirements, throughput, cost or combinations of these for particular applications.

Mr. McDade. Are you saying everything is supposed to be mandatory?

Admiral Weaver. The Navy is concerned with software because it is the most expensive part of the proposition. Our order is NDI software used first, followed by ADA, and the higher order languages. Then the standard computers and the processors are used where they are compatible, and it is mandatory that we have to get a waiver. It is mandatory that they use EMSP or the standard computers.

Mr. McDade. Is your experience such that you say it is effective and you are comfortable with it?

Admiral Weaver. Yes, sir, and I think with our next evolution in standard processors and computers, we will have modularity endorsed by industry with IEEE standards to allow us to buy off the shelf equipment.

Mr. McDade. The committee understands that DOD Acquisition Chief, John Betti was do impressed with the Navy's enhanced modular signal processor program that he requested information on expanding its use. Of the 49 DOD weapon systems identified as potential candidates for EMSP, in how many is EMSP mandatory?

Mr. CANN. At the present time, there are 49 DOD weapon systems under discussion. Ten are Navy systems which are potential EMSP users. Eight have been designated mandatory and two are review as potential EMSP users. I don't know the answer for the other services.

Mr. McDADE. Will you amplify the record to let us know what that amounts to and how many waivers have been granted in the past two years?

Mr. CANN. I would be happy to.

[The information follows:]

Four Tactical Digital Standard (TADSTAND) "B" waivers for EMSP have been granted in the past two years as follows:

Relocatable Over-the-Horizon Radar (ROTHR): was granted a waiver 11 July 88. The waiver request correctly indicated that EMSP deliveries did not support ROTHR milestones from FY85–FY88.

Combat Direction Finding (CDF) System: was granted an after-the-fact waiver 07 March 89 based on CDF's approval for limited production in June 88. The Mercury 3232 array processor was used as an off-the-shelf three card embedded processor. EMSP would have required additional equipment racks and far surpassed the processing requirements of this application.

AN/BQQ-5E Sonar: was granted a waiver on 17 Nov 88. Because of sensor limitations, the previous standard signal processor, AN/UYS-1, met throughout requirements and hardware and software were non-developmental items (NDI).

AN/APG-65 Radar Upgrade (RUG): was granted a waiver 18 May 89 because EMSP would not fit into the F/A18 space available. The Hughes processor was salvaged from the existing APG-65 design and used as NDI which allowed reuse of software from the F-14D/15.

In each case these waivers were granted prior to a 05 July 89 memorandum signed by Secretary of the Navy requiring the use of EMSP as Navy's standard signal processor.

ANTI-SUBMARINE WARFARE

Mr. McDADE. Obviously there, and especially after seeing the "Hunt for Red October" last night, we hear the ASW is your top priority and last year the Navy established a consolidated ASW development office. Describe the fiscal year 1991 R&D funding for ASW programs and tell us if is it higher or lower than last year?

Mr. CANN. For fiscal year 1990 the total ASW R&D was a little over $2 and a half billion. This year, it is about $2.7 billion. So it is up a couple of hundred million dollars.

Mr. McDADE. Now that your new office has been operating for a year, what have been its major accomplishments?

Mr. CANN. What the new office has done, under the aegis of Admiral Wolkensdorfer, is to focus on ASW technology and do a better job of coordinating DOD-wide ASW efforts. He has put real efforts into what we call ———. There is a lot of discussion about nonacoustic ASW. Clearly, the most important issue, I think, in trying to make sure that we are doing the right thing, is to make sure the data is integrated so people can use it, because the only way ASW works well is if you take information from different sources and collate it.

Mr. McDADE. What is in the 1991 R&D budget that wasn't there a year ago? What are the new initiatives?

[CLERK'S NOTE.—Classified discussion removed.]

Mr. McDADE. Having been to the movie, I can tell you what to do.

Mr. **Cann**. It was great. I just want to see the submariner who is going to go around the sea mounts at 26 knots.

Mr. **McDade**. What are the priorities of programs in the ASW category? Which are the most important and which are the least important?

Mr. **Cann**. Well, I suppose what you are really looking for, as an answer to this question, is specific programs. I have to tell you that at this time, from my point of view, and I have to make sure the committee knows that I have been involved in ASW most of my life, the real issue is to maintain our ability to detect the other guy. Whether acoustic or nonacoustic, we have to work that problem.

On the surface of that discussion, the Navy right now has a lot of programs like ———. So making sure that we have good detection capability, augmenting it with appropriate nonacustic sensors, and tying them together are clearly the number one priority, in my view.

Mr. **McDade**. We had a terrible thing with the Walkers and with the sale of the Toshiba machines. What has that done to increase the threat?

Mr. **Cann**. I think with respect to the Toshiba incident and others, we were very fortunate for a long time. ———. We knew it was going to go away, the only issue was when. We knew their propellers and propulsion trains would make noise for a while and eventually it would go away. Perhaps those things—Walker and Toshiba—allowed them to go away earlier, but they were always going to become quieter. It is a question of how much money they want to spend to get quieter.

Mr. **McDade**. The committee wants to make sure that we are supporting you and your colleagues in keeping that detection capability given the complexity of of the problem, which we know is getting more difficult.

Mr. **Cann**. If that is the issue, then the committee should be supporting very strongly all ———.

Mr. **McDade**. What is the top priority in nonacoustic?

Mr. **Cann**. Well, at this classification level, clearly the ———. But there are limitations to these things, fundamental physics limitations, and in many cases they won't work independently ——— and in a much more reliable fashion. Typically speaking, nonacoustic detection schemes require some cooperation by the target. ———.

Mr. **McDade**. Another facet of what we are trying to determine is whether or not you are comfortable that we have a national ASW program that uses all the resources of the nation. Are you comfortable that we do have a national effort and if so, how do Navy initiatives fit into it?

Mr. **Cann**. I know a fair amount about what is going on in the last five years. My own view of this is that I think the Navy has a good program. I think we had a good program.

Mr. **McDade**. I think the evidence would bear that out. Is there a national program also?

Mr. **Cann**. I can't say that I know for sure. There is an attempt. I will find out.

[The information follows:]

Navy's program is the national ASW Program. Navy's ASW programs have always benefitted from review and participation by top technical talent throughout government, industry, and academia. "Throughout government" specifically includes close interaction with ——— as well as other elements of the intelligence community. The involvement in Navy programs of such external organizations as the Defense Science Board, the Defense Advanced Research Project Agency, the National Academy of Sciences and the JASONS, in addition to Navy-chartered organizations such as the Planning and Steering Advisory Group, ensures that no ASW-related intelligence question or technological opportunity is allowed to pass without review and, wherever indicated, data collection and analysis using the most advanced equipment attainable. Finally, performers within Navy ASW programs are not confined to Navy laboratories but include, for example, the DOE National Laboratories and companies such as IBM and TRW whenever they have particular scientific or manufacturing expertise to bring to bear.

Mr. McDADE. Tell us how the Navy's initiatives fit into that. Does the Navy have a consensus position between the various platform communities today that would allow establishment of an ASW architecture?

Mr. CANN. There is a master plan which has been put together and I guess you have seen a version of it. I think things need to be constantly revised. One of the initiatives I want to review as soon as possible is what that initiative looks like to make sure that we have an architecture that will support the threat as we see it evolving, and we can grow into the proper architecture to meet that threat.

But, there is a plan.

NON-ACOUSTIC ASW

Mr. McDADE. Okay. We will be watching it with you. As you know, last year the committee moved nonacoustic ASW to OSD, and this year's budget puts it back where it was. What are your intentions with respect to that? Why do you think it is better where it is and what are your intentions in moving that back in Navy? What is the background there?

Mr. CANN. First of all, I think it should be in the Navy, without any question, and I believe that——

Mr. McDADE. Rather than OSD?

Mr. CANN. Absolutely. For many reasons. The center of gravity in terms of technical excellence is in the Navy. Most of the people who would have to get involved in looking at the programs are the same people we have been looking at them, because the number of people with expertise is limited.

We have spent a great deal of money to get the fundamental physics in hand to understand some of these nonacoustic issues, and I will make sure that I can satisfy you in our efforts on nonacoustic ASW.

I like to look at ASW as an integrated activity and that is difficult if part of it is managed by the Secretary of Defense and part by me.

Mr. McDADE. We are concerned to see there is a broad spectrum of management. How much is in the budget this year for nonacoustic ASW?

Mr. CANN. I will have to check.

Mr. McDADE. Give us that number and put into the record how you are going to use the funds.

Mr. CANN. Twenty-two point nine million dollars.

Mr. **McDade**. The expenditures you plan to make of that $22 million.

[The information follows:]

Navy's priorities for its FY 1991 non-acoustic ASW program are the same as those proposed to the Office of the Secretary of Defense for inclusion within its FY 1990 program plan. In a program whose essential element is scientifically rigorous testing of hypotheses using submarine targets in the ocean. Navy proposes to ———. The schedule of Navy's program in FY 1991 and the outyears depends in part on the allocations made in FY 1990 by the Office of the Secretary of Defense.

Mr. **McDade**. Thank you, Mr. Chairman.

Mr. **Murtha**. Mr. Dicks.

R&D FUNDING PRIORITIES

Mr. **Dicks**. Mr. Secretary, welcome.

A year ago the Reagan Administration requested $41 billion for R&D and Congress reduced that to about $36 billion. Now, when you are faced with a major reduction like that and obviously there have been some reductions under the Cheney budget, how do you go about deciding how to make those reductions in the Navy R&D spending?

Mr. **Cann**. Well, first of all, I think that is obviously a difficult question for me to answer at this time, but I will tell you what I believe:

First of all, what has to happen to make that kind of reduction is that the people who are responsible for requirements have to relook at their requirements and decide what is really important.

To amplify on this issue, I would ask Admiral Reynolds to provide comments. Clearly, the first issue is to decide what you need and what you don't need. And my role is to make sure that, whatever the requirement is, that I meet it with the best technical solution and try to field whatever system is required in the most expenditious manner for the least cost.

I know that there is a lot of discussion going on about which requirements are valid requirements, which requirements need to be perhaps reduced or eliminated in order to meet the reductions in the budget.

Mr. **Dicks**. Technical base is there, you have tactical and strategic programs, and you have a series of weapon systems that you funded. During your 1991 budget development, how many R&D lines were canceled?

Mr. **Cann**. I am going to have to ask Admiral Reynolds if he can answer that.

Mr. **Dicks**. Sure.

Admiral **Reynolds**. If I might, with respect to the prioritization, we start at a very macro level and attempt to do two things. One clearly is that ASW continues to be our key technology driver and research driver. So we take a look at that. But then we must keep a balance across all the warfare lines. For example, from ASW to strike, special warfare, sealift, all of those have to be prioritized, and although there is a prioritization, there must also be balance.

What we have found in the present situation is there are situations where the requirement continues to exist. Then the next step is to look at affordability and we have to strike a balance between prioritization, balance and affordability. I am sure that later on we will get to some programs that for clearly affordability reasons have dropped out.

Mr. DICKS. You are right about that, we will get to them. Did you cancel any in 1991?

Admiral REYNOLDS. Yes sir.

Mr. DICKS. Which one was it?

Admiral REYNOLDS. Sea Lance, for example.

Mr. DICKS. Is that the only program you cancelled?

Admiral REYNOLDS. Yes, sir.

Mr. DICKS. As you are developing your plans are you emphasizing efforts to identify programs that are not likely to proceed into production and terminating them, or will you stretch out everything?

Mr. CANN. First of all, I don't believe in stretching out programs. My view of the world is that we need to look at the weak sisters and get rid of the ones which are really weak. We are about to come into the phase of the budget preparation where we are going to start to address those issues.

I have not addressed those at this time, but will over the next two months.

Mr. DICKS. It seems to me that you are going to have to make some difficult choices. I think it is better, frankly, for you to make them. Hypothetically, I think probably Congress is going to reduce your Navy R&D budget by ten to 13 percent, somewhere in that range, just to get down to the lower number that we are going to be forced to deal with under the cuts that are going to occur.

If we do that, I'm sure you would prefer to have the discretion. Obviously there is going to be some items that Congress wants to deal with, that are the reality, but wouldn't you like to have the discretion if we were going to reduce you by ten to 13 percent overall, to decide where the cuts are going to be made?

Mr. CANN. Absolutely. I want to make sure we have a balanced program and are working on the technologies for the future.

SEA LANCE

Mr. DICKS. The Navy has proposed to cancel the Sea Lance program despite the fact that two years ago a decision was made to proceed with a system for surface ships and submarines.

Secretary Cheney testified that ASW remains the number one priority of the Navy and this is reflected in your written statement as well. Chief of Naval Operations, Admiral Trost, testified a few weeks ago to the Senate Armed Services Committee that Sea Lance is the only long-range standoff weapon in development for surface ships and submarines. It has a continuing priority. The requirement has not changed. In light of this, what rationale was used to justify termination of the Sea Lance program?

Mr. CANN. Having not been there, I can only tell you what I have learned since I have been back in the Pentagon. There was a major slip in the program of up to two years. There was a life cycle cost increase of about $935 million caused by the concept of making it a dual use weapon and due to the integration requirements in the surface ship program.

My understanding is that as a result of the slip in the IOC and delay of two years and because of the fiscal climate, it became an affordability issue and the program was cancelled.

Mr. DICKS. There has been some concern expressed over the cost growth and schedule slippage in the program. What factors were involved in this and what effect did the decision to go from a nuclear payload to the MK-50 torpedo have on the program? If you want to have one of the Navy Admirals respond——

Mr. CANN. I will.

I am going to ask Admiral Hekman to answer the question about the specifics of the cost growth because I don't know them. I do know that the switch from the nuclear payload to the torpedo was made some time ago.

Mr. DICKS. Let me go back to what you said. The increase in cost of $935 million is not an increase in development costs, it is an increase in 30-year life cycle costs. It is not driven by development problems, it consists of the following elements: two year schedule slide all phases, which is basically directed by the Navy; added surface fleet firings excluded from the original estimates; inflation increase due to revised escalation rates; increased production because of recurring hardware costs; added system phase-out costs excluded in original estimates; and increased understanding of the work to be done.

So we are not talking about development here, we are talking about 30-year life cycle costs and I want to get that on the record.

Let's go back to the two year schedule slide. The reasons are the Navy decision to delete authorization for low rate production, which the committee said was a very serious mistake in judgment, and a Navy decision to stretch out the flight test program that resulted in a mismatch of funding requirements for FY 1990 and 1991, for which Congress has some partial responsibility.

The big change here, of course, is that we decided to go with a common weapon that could do both the surface mission and the submarine mission. Now the Soviets have a standoff weapon. Because of this decision, we will not have one. You know the vertical launch ASROC doesn't have the range or the capability and can only be used on surface ships.

Mr. DICKS. Secretary Betti is saying that the VLA program is in serious trouble. I don't understand why you didn't cancel it as the Navy did two years ago, and stay with a system that can be used both on submarines and surface ships. Sea Lance has greater range, greater capability, and it is clearly required as the Navy standoff weapon system.

To say ASW is your number one priority and then kill your only standoff system for surface ships and submarines simply doesn't make any sense.

Mr. CANN. Let me take this opportunity for Admiral Hekman and Admiral Reynolds to make whatever comments they feel appropriate to respond to your issue.

Admiral Hekman.

Admiral HEKMAN. As the producer of the system, but not a player in the decision as to which one to proceed with, I was party to some earlier ongoing dicussion regarding the single weapon and it was primarily an affordability issue.

Mr. Dicks. It is hard to hear without the microphone.

Admiral Hekman. The decisions were primarily for affordability. A requirement continues to exist for the weapons system. We have taken the system and initiated the testing of the vertical launch part of it; the rocket system. The two launches were successful and we are now placing the system on the shelf. It is a system that we could complete testing and go into production with. We still have some interface testing to do with the MK-50 torpedo.

Mr. Dicks. I don't mean to say this harshly, but you are not correct. There is $300 million of R&D remaining to be done. If you leave it where it is now, we are not completing R&D.

Admiral Hekman. I agree.

Mr. Dicks. Are you familiar, Admiral, with the exchange exercises that have been done with or without Sea Lance?

Admiral Hekman. No, sir.

Mr. Dicks. The Secretary of the Navy wasn't either. I find this amazing that the people at your level are not familiar with the range exercises that show what happens to—in exchanges between surface ships and submarines against their submarines with and without Sea Lance.

Admiral Hekman. I misunderstood your question. I am familiar with that.

Mr. Dicks. Is it not true that we do much better with Sea Lance than we do without it in those exchange exercises. Can you describe for the committee what those exercises show?

Admiral Hekman. The exercises show that we have a net gain from that type of weapons system.

Mr. Dicks. If you don't have the details here, I would like to have that for the record.

[The information follows:]

Four range exercises were designed specifically to evaluate how well a U.S. submarine could localize a simulated threat submarine at ranges in excess of effective torpedo engagement ranges. The operating area and season provided favorable acoustic conditions for each of these exercises. Submarines participating simulated the employment of a missile-borne weapon with unlimited range (no exercise weapons were actually used).

RANGEX 1-80 and 1-80 were the first exercises to examine long range, anti-submarine targeting in the open ocean and used relatively high noise level targets.

———.

Mr. Dicks. We do much better with Sea Lance than without it?

Admiral Heckman. It is a positive gain, but the amount of that gain, or the leverage you get from it would have to be supplied for the record.

[Clerk's note.—The Department was unable to provide a response in time to be printed in this hearing volume.]

Mr. Dicks. Fine.

You justify Sea Lance termination due to affordability reasons. The total cost of the remaining program is between the cost of two or three SSN-21s. Are you testifying that the contribution that a force of say 40 SSN-21s without Sea Lance is more militarily effective than a force of say 38 SSN-21s with Sea Lance, and do you have any analysis to support that assertion?

Mr. Cann. You have indicated I testified to that?

Mr. Dicks. I am saying are you testifying that the contribution that——

Mr. **Cann**. I am not testifying to that.

Mr. **Dicks**. What bothers me here is that we are going to spend $1.5 billion or there abouts per SSN-21. But we are not going to have the most effective weapons that are available on it and when the Soviets have a standoff weapon of this nature, as I understand it, you are creating a sanctuary in which they could hit us from a standoff distance but we can't get them because our torpedos only have a range of ———.

Mr. **Cann**. I am not here to be contentious and I wasn't part of this decision, but the Soviet——

Mr. **Dicks**. No, because I don't think you would have made the decision like this.

Mr. **Cann**. The issue of the Soviet standoff from our submarines is, in my judgment, not a potentially valid point because I don't think they could detect our submarines far enough away.

Mr. **Dicks**. Can you continue to be sure of that in the future as they continue to improve?

Mr. **Cann**. I believe that the kind of counter programs we have will insure that that doesn't happen over time.

Mr. **Dicks**. What about with surface ships, because you are going to have a weapon with limited range, you are going to have to get closer to those submarines or you are not going to be able to attack them because vertical launched ASROC has a limited range compared to Sea Lance.

Mr. **Cann**. I am not trying to defend the issue here. The surface ships do have LAMPS.

Mr. **Dicks**. But they can only operate in certain weather conditions. There is a speed factor of getting the missile to the submarine in time and you have limited numbers of those helicopters, so that isn't a satisfactory answer for anybody that has looked at this.

A standoff missile gives you speed, it gives you range, and those are things you don't get with LAMPS. You can't get out there that fast.

Mr. **AuCoin**. Would the gentleman yield?

It might be helpful for the committee to know what the range of Soviet standoff missile capability is. Can you tell the committee?

Mr. **Cann**. I will have to supply that for the record. I don't have the exact number.

[**Clerk's note**.—The Department was unable to provide a response in time to be printed in this hearing volume.]

Mr. **Dicks**. Does anybody here know?

Mr. **Cann**. Several miles. The way I understand it they had a range of ———. So in a sense, you would have a sanctuary where they could, if they could detect you, which is an issue, hit you and you couldn't respond. We are spending all this money on a new submarine and to not give it the most capable weapon that is available ———.

Mr. **Dicks**. ——— miles?

Mr. **Cann**. Admiral Reynolds represents the requirements side of this issue. He is also the former COMSUBPAC and perhaps he could comment.

Mr. **Dicks**. We would be delighted to hear from him.

Admiral **Reynolds**. Thank you, sir.

For 30 months prior to my coming to this job in November, I was Commander of the U.S. Pacific Fleet. We have plenty of guys like Sean Connery—more than 50 on the Pacific.

Mr. **AuCoin**. Do we have choreographers that will search the Baltic as effectively as the "Hunt for Red October"?

Admiral **Reynolds**. The guys who won were the guys in the white hats. With respect to the issue at hand, I would like to make two points.

One, the requirement for a standoff ASW weapon remains. It has been established and documented. The affordability issue was the problem that we had. However, with respect to what kind of jeopardy does it put us in, whether yor have more submarines or more weapons, et cetera, I would suggest that my experience of more than 30 years in submarines tells me that it is the synergistic effect of the submarine platform, the sensors themselves, and the reach of the combination of weapons that is very important.

I sometimes am concerned that there is focus on individual parts of the system as opposed to viewing the submarine or any weapon system as a total system.

For example, in the case of the weapons load on a nuclear attack submarine today and SSN-21 in the future, I think we have to consider the volume that is swept out by our platform, a combination of its sensors, its acoustic capabilities, and the speed with which it can move with very enhanced acoustic capabilities, and couples that—the platform, the sensors, and the capabilities of the weapons that we have at hand.

I am confident today, because of may recent experience, that were our people put in the position of exchange, we clearly have the upper hand, because of those combinations of three things, plus the aggressive training and absolutely top notch people that man our submarines today.

So, yes, I acknowledge that you would like——

Mr. **Dicks**. You would be more effective with Sea Lance than you would be without it?

Admiral **Reynolds**. Certainly.

SSN-21

Mr. **Murtha**. You are making a comparison with the noise that the Soviet submarines make now, is that how we are talking—if they are as quiet as ours, you still have the same confidence in our system?

Admiral **Reynolds**. Today they are not. The reason we so desperately need SSN-21 is so that the future, as they continue their trend in quieting, that we maintain that acoustic advantage.

Mr. **Murtha**. Talk about that a bit, because one of the suggestions by the House Budget Committee is to cut out one or two of the new submarines. You are saying that it essentially quieter and what other capability does it have that is so essential?

Admiral **Reynolds**. As a Force Commander, the second most important capability after its stealth and acoustic abilities is the firepower that the ship has. As an operational commander, the single biggest drawback I had once I was facing the enemy was the ability to carry weapons. SSN-21 essentially doubles the weapons load.

Mr. Murtha. How do you answer the question that the threat has receded substantially, so while we keep the ballistic missile submarines as the deterrent, we do not need an improved submarine at this point in our history?

Admiral **Reynolds**. I am delighted I have the opportunity to address that question, because, as Secretary Cann pointed out, technology tends to go foward whether there is potential conflict or high threat, or peace. I would submit that there is a possibility that technology moves further, faster in times of lessened threat. I would point out, sir, that our sailors and airmen and Marines, regardless of force structure, will face the best technology that any potential enemy can put on the street.

Just this past week I looked at how the number of countries producing submarines and having submarines has increased in 20 year segments. The reality is, it is a growth business and had we chosen stealth missiles, for example, to examine instead of submarines, I think we would find the proliferation of sophisticated weapons is moving forward at a rapid pace.

So, although we may face reduced force structure, clearly our people will face very sophisticated weapons in the future.

Mr. **Murtha**. Are you saying that the Russians are continuing to improve their technology?

Admiral **Reynolds**. Absolutely.

Mr. **Murtha**. What is the latest Soviet submarine class?

Admiral **Reynolds**. Akula.

Mr. **Murtha**. It is quiet as what, compared to our submarines?

Admiral **Reynolds**. It is a significant improvement over anything they had in the past. When you combine platform, weapons, sensors, people, and so forth, the Akula is not a match for our best submarine.

Mr. **Murtha**. It is not a match for the submarines in the arsenal today, so we still have the upper hand. Will they continue to quiet and improve their submarines?

Mr. **Cann**. No question about it.

Mr. **Murtha**. No question about it, there is a distinct possibility that with the budget figures we are given, that two submarines are going to come out. I know the consequences, I think. You are saying your professional opinion is that the Russians are continuing to modernize their fleet but you are also saying that the submarines we have in our arsenal today are still better than their Akula, which is their latest class?

Mr. **Cann**. Yes, but on the Akula, as time goes on, they will make incremental changes, find out what is making noise and fix it.

Mr. **Murtha**. Do we have a window of ten years or five years that we would continue to be the superior, have a superior weapon system?

Mr. **Cann**. I will have to supply that for the record.

[Clerk's note.—Classified insert removed.]

Mr. **Murtha**. Mr. Miller.

ANTI-SHIP CRUISE MISSILES

Mr. **Miller**. Thank you, Mr. Chairman.

Earlier this year the Chief of Naval Operations testified that 102 countries now possess cruise missiles. How serious is this threat to our surface ships and how effective are the current defensive systems against cruise missiles?

Mr. **Cann**. I think that at this juncture, I would have to ask Admiral Reynolds if he has a view on that. Otherwise, I will have to take that for the record.

Admiral **Reynolds**. Yes sir. Of course, the Aegis class cruiser is our most formidable AAW platform at sea today, and DDG-51, the Arleigh Burke class, will be following that ship. I think it is a very parallel situation to the submarine situation, where we have a technology that we are coping with today and I am comfortable that the testing of the Aegis class cruiser has proven that.

However, the Soviets and others, because of the availability of stealth weapons through foreign military sales, will continue to improve. So yes, I believe we are in a satisfactory situation today, but it is imperative that the balanced program that has been put on the table move forward to stay abreast of those type missiles.

SPARE PARTS ACQUISITION

Mr. **Miller**. I notice, Mr. Secretary, that you also say that part of your responsibility is being the Navy senior procurement executive.

Mr. **Cann**. Yes.

Mr. **Miller**. The committee is concerned about the management of spare parts. We held two hearings on this particular subject, and the RAMP program was discussed at that time.

It appears that the commercial sector is ahead of government procurement practices at the present time, and we are a little slow on getting the parts inventories moving and ordered when needed. I know that we have to have a backup, that parts for defense systems are something special; but by the same token, the commercial area is moving.

How do we stand in this?

Mr. **Cann**. Congressman Miller, I am prepared to discuss R&D, but to be very candid with you, at this time, I don't know anything at all about the spare parts program. I will know about it next time I come over here, but perhaps one of the gentlemen with me is in a position to discuss it.

This is Admiral Gentz, Naval Air Systems Command.

Admiral **Gentz**. If I may, sir, I have become a lot smarter since the last time I was before the committee while discussing RAMP. RAMP is a program that the Naval Air Systems Command is assisting in managing.

From the perspective of some things that are going on, there are a number of activities and RAMP is in fact, to a greater degree than I was even aware the last time I came here, doing some of the things that you are concerned about.

I have my response to the question for the record from my last testimony, which will be submitted, or if you would like I can discuss it now.

Mr. **Miller**. Any information you can give, I would appreciate it.

[The information follows:]

The RAMP Project emphasizes the application of computer integrated manufacturing and acquisition technology in support of low volume, high mix production of spare parts. Essentially, RAMP targets a "parts on demand" production capability. RAMP program objectives include:

Manufacture difficult to obtain parts critical to fleet support operations in a responsive, cost effective and automated manner.

Reduce current total average production leadtimes from 300-700 days to 30-60 days.

Transfer RAMP technology to U.S. industrial base to provide capability for Just-In-Time support of DoD requirements.

Our initial prototypes will be installed at Navy depot activities to modernize their shop capabilities, as well as provide a capability to manufacture critical spares when industry sources are not available or leadtimes are excessive. Although the prototype shop equipment targets a small part range relative to the total Navy inventory, the RAMP architecture and concept can apply to the total Navy inventory. The two prototype commodities to be manufactured are Small Mechanical Parts and Printed Wiring Assemblies as follows:

	Range	Throughput/Year
Small mechanical parts (SMP)	3,000	15,000
Printed wiring assemblies (PWA)	3,000	15,000

Note.—Initial Navy installations are scheduled as follows: Naval Aviation Depot, Cherry Point: SMP Cell by Sep 1991; Naval Avionics Center, Indianapolis: PWA Cell by Mar 1992; Naval Shipyard, Charleston: SMP Cell by Sep 1993.

The key to the RAMP system is the use of a next generation technical product standard currently being coordinated with industry by the National Institute of Standards and Technology (NIST). This new standard, Product Data Exchange Specification (PDES), is a critical factor in being able to communicate technical data information between the various computer hardware and software used in industry and government today.

PDES goes beyond current U.S. standards in that it will enable clear unambiguous transfer of product information that is capable of automatic interpretation by the computer, as well as human interpretation. PDES enables RAMP to significantly reduce manufacturing lead times and increase quality production of spares. The PDES effort is fully supported by industry as a mechanism for making the industrial base competitive with off-shore manufacturers. RAMP is the first Flexible Computer Integrated Manufacturing (FCIM) system to use the emerging PDES standard.

The largest impact of RAMP will occur when the PDES standard matures, weapon system technical data is acquired in PDES format and the U.S. industrial base moves to RAMP-like manufacturing. This allows the DoD Inventory and Program Managers to plan spares levels around reduced leadtimes. The Department of Commerce and the Navy are jointly promoting rapid deployment of FCIM and PDES as a National priority. In the interim, Navy will update leadtime databases at the Inventory Control Points as items are transitioned for RAMP-like production in industry. Thus, the Navy spares budgets will automatically incorporate RAMP impact on leadtimes, resulting in lower inventory levels and lower costs to support the fleet spares requirements.

Admiral **Gentz**. We are doing two prototypes within the NAVAIR Systems Command activities, and one at the Navy shipyard at Charleston. We have the cells that will be coming on board shortly.

I mentioned the last time I testified that there was going to be a ribbon cutting. That happened in Indianapolis and at that time, the folks looking at the capability were extremely impressed. There will be a range of 3,000 small mechanical parts and 3,000 printed wire assemblies of the types of things that you would like to have the capability to manufacture and you can throughput 15,000 piece parts a year in each category so we will have a great deal of capability. That still represents a relatively small percentage of the total types of things that we have to buy, of course, because there are forgings and other types of things which are not part of the RAMP process.

INTERNATIONAL R&D

Mr. MILLER. In another area, Mr. Secretary, you speak of international research and development.

Mr. CANN. Right.

Mr. MILLER. Apparently we would be involved with other countries on developing various items that would be needed for the Navy. Can you give us a little background of how we are working with other countries and to what extent we share our technology?

Mr. CANN. Well, this is a very broad subject and I am prepared to discuss this subject for the rest of the day, as a matter of fact, but I don't think that that is what we are here to do.

I would like to make the point that cooperative research and development has been part of the DOD efforts for many years, especially in the research area. In recent years, there has been an attempt to co-develop.

I had the privilege of chairing last summer a Navy Research Advisory Committee study on cooperative research and development. The committee found that one of the difficulties with organizing these cooperative developments had to do with getting together all of the disparate parts of the community. The Congress has a view pro and con of various aspects of cooperative R&D. The Commerce Department, Navy Department and DOD have a role.

Mr. MILLER. You are talking of exporting?

Mr. CANN. Cooperative R&D includes export of technology. Once you agree to co-develop something, you invariably end up exporting technology.

The Navy has taken a position of having a tight control over the export of technology which is unique to our sovereign capability. We want to make sure that we are not giving away technology that is going to come back and bite us some day or cause us to spend money to counter the technology that we just gave away.

We had programs we thought would be successful which were cancelled for one or more reasons. I anticipate that with the pressure on the budget not only in this country, but in allied countries, that we are going to find ourselves enjoined to work more closely with our allies on cooperative R&D and the issue will be proliferation.

You have to make sure you have an agreement with the party you are cooperating with, that they are not going to sell the technology to people you don't want them to.

Mr. MILLER. It is hard enough for us to keep it when only we know, but once we get into international programs we are not sure how far it branches out from that.

Can you give examples of what has taken place in international R&D?

Mr. CANN. Yes, sir. Coming immediately to mind is the RAM missile developed with the West Germans. I would prefer, if I may, because I have been out of the building for five years, to supply for the record concrete examples of cooperative R&D that we have had with our allies.

[The information follows:]

10 April 1990

DEPARTMENT OF THE NAVY COOPERATIVE R&D EFFORTS WITH ALLIES

MOU SUBJECT	DESCRIPTION	COUNTRY(S)	DATE
Active Electronic Decoy Development (Project Nulka) MOA	Shipboard launched anti-ship missile decoy	Australia	08/01/86
Infrared Search & Target Designation (IRST-AN/SAR 8) Development MOU	Shipboard IR detection of enemy surface/airborne threats	Canada	01/01/83
APG-65 Radar Upgrade MOU	Improved multi-mode (air-to-air, air-to-ground) radar	Canada	03/29/90 (US)
Rolling Airframe Missile Advanced (EX-31) Advanced Development MOU	New surface-to-air point defense missile system	Germany, Denmark	07/22/76
Rolling Airframe Missile (EX-31) Full Scale Engineering Development MOU	Full scale development of RAM	Germany, Denmark	05/18/79
Rolling Airframe Missile (EX-31) Joint Production MOU	Joint production of RAM	Germany	08/03/87
MPA-90 General and Harmonization MOU	Maritime Patrol Aircraft (P-7A ASW) and associated avionics (Update IV)	Germany	04/05/89
Multi-Mission Optronic Stabilized Payload (MOSP) for Remotely Piloted Vehicles (RPVs)	Optically stable reconnaissance equipment for RPVs	Israel	07/06/88
T&E/Applied R&D of Penguin Missile Sys for Helicopter Use MOU	Short-range helo-launched anti-ship missile	Norway	09/19/86

MOU SUBJECT	DESCRIPTION	COUNTRY(S)	DATE
AV-8B/GR5 Development, Production & Support MOU	Multi-role USMC attack aircraft derivative of AV-8A	United Kingdom	07/07/81
Surface Ship Torpedo Defense Concept Exploration MOU	Survey to explore development of anti-torpedo ship system	United Kingdom	10/26/88
NATO SEASPARROW Cooperative Support MOU	Logistics support of NATO SEASPARROW missile system	Belgium, Denmark Germany, Netherlands, Norway, Italy	05/20/77
NATO SEA GNAT International Development MOU	Ship-launched anti-ship missile defense	Denmark, Germany Norway, UK	12/08/76
NATO SEA GNAT Production MOU	Production of SEA GNAT	Denmark, U.K.	07/09/86
NATO Anti-Air Warfare Sys Concept Exploration Phase MOU	Integrated shipboard AAW system	Canada, Germany, Netherlands, Spain, UK	10/19/87
NATO Shipboard Inertial Navigation Development MOU	Ship navigation improvement	Canada, Germany, Netherlands, Spain	03/06/87
NATO LINK-11 Development MOU	Improved NATO data link for ships and aircraft	Canada, Germany, Netherlands, UK, France, Italy, Norway	10/19/87
NATO Frigate Replacement for the 90s Feasibility Study Phase MOU	New ship hull design	Canada, Germany, France, Italy Netherlands, Spain, UK	05/15/84 (Program recently cancelled)

Mr. MILLER. Thank you, Mr. Secretary.

Thank you, Mr. Chairman.

Mr. MURTHA. Mr. AuCoin.

STANDARD EMBEDDED COMPUTERS

Mr. AUCOIN. Thank you very much, Mr. Chairman.

Let me get my thoughts together here. First I have several questions from our colleague, Mr. Sabo, who is unable to attend the hearing today, and I would like to have those submitted for the record.

[CLERK'S NOTE.—Questions submitted by Mr. Sabo and the answers thereto follow:]

Question. For some years, the Navy and Congress have been working together to encourage the use of standard computer systems on Navy ships and weapons. Over the last several years the appropriating and authorizing committees have approved funding levels and report language designed to encourage this standardization. Last year, for example, this subcommittee added funding to help integrate the UYS-2 standard signal processor into the SQQ-89 sonar system. And current Navy policy (OPNAVINST 5200.28) requires the use of Standard Embedded Computer Resources, both hardware and software, in all mission critical acquisition programs.

Can you tell me, is this Navy policy still being followed? For example, does the Navy plan to use standard computer systems on the SSN-21? It is my understanding that a waiver has been requested from this policy for the upgrade to the SQQ-89(I) sonar combat system. Is this true? If so, how would the Navy explain a deviation from the policy which has demonstrated such strong Congressional support? Can you explain the waiver process? At what point in the acquisition process are waiver requests submitted? What criteria does the Navy use in determining whether waivers are granted? Who makes the decision? Does the decision include any consideration for increased future costs for maintenance and non-standard systems?

Answer. Navy's policy regarding the use of standard computers and signal processors is being followed. Waivers may be granted in accordance with standard policy when system specific requirements cannot be met by a Navy standard or when it is far more cost-effective to use an alternative. The mission critical systems of the SSN-21 will be built around Navy standard computers and EMSP. Additionally, embedded microprocessors within the system that perform some dedicated functions such as local controllers, interface devices and display processors will be used.

Source selection has not been made for the SQQ-89(I). The Request For Proposal (RFP) stipulates that options submitted must include the use of Navy standard computers as well as EMSP. As with most RFPs, economical alternatives are encouraged in the offerers' replies. If a proposal is selected which does not intend to use a Navy standard computer, it would require a waiver in accordance with the process described below.

The standards policy was developed to prevent the proliferation of non-standard computers and signal processors for logistics and software portability reasons. Program managers requiring mission critical computers or signal processors are required by direction to use Navy standards unless authorized by waiver to develop or use an alternative. Requests for waivers are submitted to the approving authority once a program manager recognizes that a waiver is required or desired. Typically, this happens at or before Preliminary Design Review and before approval for Full Scale Engineering Development at Milestone II. Waiver requests are evaluated on a cost (life-cycle), performance and schedule basis. Application specific requirements like size, weight, power consumption, or environmental constraints may require considering logical, cost-effective alternatives.

The waiver approval authority for standard computers is COMSPAWARSYSCOM, who also processes waiver requests for signal processors. Waiver approval authority for signal processors currently is the Secretary of the Navy.

P-7 MARITIME PATROL AIRCRAFT

Question. I understand from press accounts that the contractor now estimates that the P-7 ASW partol plane will cost $62-65 million apiece, which is a substantial increase from the original projection of $38 million. Is this true?

Answer. On November 15, 1990, Lockheed Aeronautical Systems Company announced problems with the P-7 program. They have subsequently filed a $300 million tax loss for 4th quarter 1989. Lockheed is conducting an exhaustive rebaseline effort on the entire P-7 program to provide the Navy a latest revised estimate for the FSED and production program. Lockheed has projected that the cost of the production aircraft will increase but the Navy has not received a final cost estimate from Lockheed at this time. The price the Navy will pay, however, is bounded by the ceiling price of the fixed price contract options.

Question. Does the increased cost include all necessary systems, such as the mission avionics?

Answer. The Lockheed price does not inlcude the cost of the mission avionics. Mission avionics are procured under a separate contract from the Boeing Aerospace and Electronics Company. The price of these kits are on a firm-fixed price contract basis.

Question. What is the total program cost?

Answer. Our original estimate of the P-7A program cost, RDT&E plus weapon system cost (cost of initial spares not included) was $7,689 million. This assumed an aircraft price near the contract target price. If Lockheed's problems drive the contract costs to the ceilings established in the fixed price incentive contract the program cost, as defined above, could increase to $9,294 million.

Question. Have the problems with the aircraft caused any delays in the schedule?

Answer. Lockheed feels that the present FSED schedule will be extended by two years. The Navy is evaluating Lockheed's position but feel that a two-year schedule slip will probably be required to complete the FSED program.

Question. Now that we know the contractor's proposal for the P-7 was severely flawed, is the Navy re-examining alternatives to the

P-7 such as further improvements to the older P-3 patrol planes or reopening the program competition?

Answer. The Navy feels the P-7A is the best aircraft to meet the operational requirements for a long range air ASW aircraft. The Navy is working closely with Lockheed to restructure a program that will produce the P-7 within the present contract. The Navy has evaluated alternatives to the P-7 but feels the P-7 is still the best aircraft to meet our needs. The Navy is looking at a recompetition as a viable alternative at this time.

Question. Would the Navy have chosen this aircraft in the original competition if the contractor had proposed it at a cost of $65 million each?

Answer. While aircraft unit cost was an important factor in the P-7 competition, the Lockheed aircraft had other advantages that would have been very important in the overall selection. Life cycle cost, integrated logistic support and schedule were also important factors.

Question. What does the Navy intend to do about this problem?

Answer. The Navy and Lockheed has been working to restructure a program that will meet all requirements within the present contract bounds.

[CLERK'S NOTE.—End of questions submitted by Mr. Sabo.]

Mr. MURTHA. We also have questions from Mr. Hefner and Mr. McDade.

[CLERK'S NOTE.—Questions submitted by Mr. Hefner and the answers thereto follow:]

STANDARDS

Question. Good morning Mr. Secretary. Since this is your first visit to our subcommittee I would like to add my welcome to that of my colleagues. We look forward to working with you.

Mr. Secretary, I understand that in your previous tour in the Pentagon you were considered by many to be a strong advocate for standards. Now that you have been away for a while, have your views on the benefits of standards changed?

Answer. In general, establishment of standards leads towards improved military readiness and interoperability between elements of the Department of Defense. Use of standard products and procedures leads to life cycle cost benefits, higher reliability, an established logistic support base, simplified training and better technical documentation. Conversely, blind adherence to an obsolete standard results in restrictions to technical advances. All decisions in the use of standards must be reviewed on a case by case basis to ensure a balanced approach.

AN/SQQ-89I

Question. When Secretary Garrett and the CNO testified this year, they emphasized the continued importance of ASW regardless of the changes in the Soviet Union. One of the main ASW programs for the Surface fleet is the SQQ-89. The Navy had hoped to bring the SQQ-89I (or improved program) on line beginning in 1995. Given the budget problems you now face is this still a realistic date?

I believe the SQQ–89I is an important step and I hope you will be able to bring that capability to the fleet as soon as possible.

Answer. The AN/SQQ–89I Improved Program will be presented to OSD for a decision to begin Full-Scale Engineering Development (FSED) this year (FY 1990). Pending OSD approval to begin FSED and a subsequent favorable OSD review in FY 1995 to initiate production, the Navy intends to commence procurement of AN/SQQ–89I systems beginning in FY 1995, providing Congress continues to support submitted AN/SQQ–89I developmental funding requirements.

NAVY COOPERATIVE ENGAGEMENT ARCHITECTURE

Question. I recently heard about a new program the Navy is developing called the Cooperative Engagement Capability. I understand this will provide significant improvement in our ability to coordinate our fleet defense against the air threat. Could you tell the committee about it?

Answer. Cooperative Engagement capability is a means of improving effectiveness of warfighting units through more efficient scheduling and tasking of individual platform combat systems, sensors and weapons. The Navy is currently developing the overall Force Cooperative Engagement architecture which will be used as the basis of consistent definitions of future system modifications and acquisitions, when appropriate. One specific implementation of Cooperative Engagement capability is the Data Distribution System & Cooperative Engagement Processor (DDS/CEP) program, which is the surface combatant component of Force Cooperative Engagement architecture. The DDS/CEP is funded for an at-sea demonstration in August fiscal year 1990.

[CLERK'S NOTE.—End of questions submitted by Mr. Hefner. Questions submitted by Mr. McDade and the answers thereto follow:]

AVIATION LIFE SUPPORT SYSTEMS

Question. Last year Congress added $3.738 million to the Navy's Aviation Life Support Systems (Advanced development) funding in order to transition the Air Force-developed "Combat Edge" high-g protection technology into Navy high-performance fighters.

Summarize the Navy's efforts to date in applying Combat Edge-type technologies to the F/A–18 and F–14.

Answer. Negotiations to use USAF in-place contracts for the Navy Combat Edge effort have been finalized and HMD/S proposals submitted in response to a BAA (Broad Agency Announcement) have been evaluated and are ready for contract award.

Question. Describe the obligational status, contracts awards and development milestones associated with the fiscal 1990 funding provided for this purpose.

Answer. The fiscal 1990 funding was appropriated, but not authorized. Therefore, no funds have been released for obligation on this program. No contracts have yet been awarded.

Question. Are there funds in the fiscal 1991 request to continue this work? If not, why? What amount of fiscal year 1991 funding would be required to continue the program?

Answer. No funding was budgeted in fiscal 1991 to continue this joint advanced development. Congressional action which appropriated $3.738 million to initiate Navy efforts in FY 1990 occured after the Navy's FY 1990 budget had been developed and submitted. To continue this effort in fiscal year 1991 $3.7 million would be required.

Question. What plans are there to transition Combat Edge technologies into fleet aviation? Please provide a schedule summary of the scope of work required and anticipated funding requirements.

Answer. Transition of the USAF version of the Combat Edge into F-16N aggressor aircraft will be immediately with an IOC (Initial Operating Capability) in fiscal 1991. Application of this technology to other aircraft is being studied but no definite plans have been established for its incorporation.

LASER GUIDED TRAINING ROUND

Question. Last year Congress provided $10 million to complete development and initiate procurement of the Laser Guided Training Round (LGTR).

Of this amount, $2.5 million was to complete development of the LGTR. Please provide details regarding the status of this effort, to include: (a) Obligation status/contract awards associated with the fiscal year 1989 and 1990 development funding for LGTR; (b) Description of the scope and schedule milestones associated with the development effort.

Answer. (a) Of the $4.0 million FY 1989 R&D funds available for the present LTGR effort, $3.48 million (87%) is obligated. Of that amount, $3.08 million was awarded to Loral Control Systems (LCS) on a 12-month development contract. Negotiations are in progress with LCS for modification of the existing contract to procure ballistic test models and obligate the remainder of the $4.0 million. The $2.5 million FY 1990 funds will be required by July 1990 (RFP release date) for a phase II contract award slated not later than January 1991. Presently, these funds are appropriated but not authorized, and not available to the program. (b) The LTGR program is divided into 3 phases. Phase I, under contract, will develop and fight test 8 prototypes and complete in December 1990. If phase I is successful, a nine month, phase II contract will be awarded in January 1991 or earlier for final development and Government testing of 30 units. Phase III will procure 1500 LGTR's.

Question. The Committee has been advised that no additional development funding is required for this program. Is this correct?

Answer. According to estimates submitted by LCS, no additional funding should be required. Actual contract negotiation won't begin until first quarter FY 1991.

Question. Please describe the current procurement acquisition plan.

Answer. $7.5 million of the FY 1990 funding is earmarked for procurement of approximately 1500 LGTRs under an option in the anticipated phase II contract. The option would be exercised in September 1991 following successful qualification in phase II. The funding is currently appropriated but not authorized and is not yet avaliable to the program.

Question. The LGTR would appear to have benefits in training not only Navy flight crews but also Marine aviators and also the Air Force. Are any efforts underway to explore Marine Corps and Air Force participation in this program?

Answer. The 1500 LGTRs will be pre-positioned at the Naval Strike Warfare Center at Fallon, Nevada. They will be available for both Navy and Marine Corps squadrons to use for training when they are at Fallon. Since the Navy's Strike/ASUW Master Plan directs the phase-out of laser guided weapons in the late 1990's, additional training can be accomplished by drawing down the actual laser guided bomb inventory in the 90's. Also, other training capabilities exist such as the TACTs range upgrades which allow aircrew weapon delivery training and scoring without actual weapon expenditure. Therefore, there has been no additional interest by the Marine Corps to get involved in the development. The USAF is aware of the LGTR, but has not expressed interest in its development. There are no efforts currently ongoing to obtain USAF participation.

Question. The low-cost training provided by the LGTR is a cost-effective alternative to using live ordnance. Does the Navy have any plans to consider the development or procurement of other guided training munitions, beside the laser-guided variant, for air crew training.

Answer. We have no plans to develop or procure guided training munitions for other weapons currently in the inventory. As new weapons are developed we will evaluate guided training munitions as well as other approaches to determine the most cost effective way to meet our training requirements.

[CLERK'S NOTE.—End of questions submitted by Mr. McDade.]

SSN-21

Mr. AUCOIN. I would like to follow up on the line of questioning that you were pursuing on the SSN-21. I wonder if Admiral Reynolds would return to the table because he was responding in part, and maybe both gentlemen could respond to this.

Mr. Secretary, one of the themes you brought out in your statement is that the ongoing need for a robust naval capability is for mobility and projection mobility; you made a big point of that. It would seem to me that in the first place, that one could argue that the priority of this committee set in providing for sealift capability is a more defensible priority than putting resources into SSN-21s at this particular moment in history.

If we are going to have to shrink our forces, if we are going to have more deployed here than stationed permanently abroad, if we are going to have them highly mobile, if you were going to prioritize, one could argue that this committee's prioritization on sealift last year, which met a deferral, is a higher priority than investing in the SSN-21. We are dealing with necessities and priorities first.

How do you respond to that, Mr. Secretary?

Mr. CANN. I have to really make it clear to people as we move into this new organization that my charter as the Navy Acquisition Executive is to execute for the Secretary programs that have been dictated as being those that are required and funded. While I might have opinions on various and sundry requirements issues, my role, as I see it, is to make sure that we are not violating the laws of physics, that we are going to buy what can, with the best technology, at the best price, and get the job done.

The issue between sealift and SSN-21——

Mr. AuCoin. That is above your pay grade?

Mr. Cann. Way above my pay grade.

SUBMARINE THREAT

Mr. AuCoin. Let me move into a discussion the Chairman started on SSN-21s. We are confronted with severe budget constraints and I was listening carefully to the responses, Admiral Reynolds, that you gave the Chairman about the relative capability of the attack submarines on each side. And I heard you say that our Los Angeles class submarine is more capable than anything the Soviets have today.

I did hear you correctly, isn't that correct?

Admiral Reynolds. Yes, sir.

Mr. AuCoin. Then I heard you say that we need, however, to keep in mind that submarine warfare is really a growth industry, which I took to mean that we have so much submarine capability sprouting up around the world that just because we have superiority today, we ought not to be sanguine about that.

That is correct, too, isn't it?

Admiral Reynolds. Yes, sir.

Mr. AuCoin. Will you describe where this growth industry is manifesting itself, what nations are developing a submarine capability that in any way comes close to what even the Soviets have and we are superior to what the Soviets have; what are you talking about?

Admiral Reynolds. I would be happy to talk about that.

Mr. AuCoin. India has a Victor class submarine, but that is no match for the Los Angeles, is it?

Admiral Reynolds. There are nuclear and diesel submarines around the world, and I would be happy to provide a list of those 40-some countries around the world with submarines.

Mr. AuCoin. We are talking about going beyond the Los Angeles class. Why can't that class submarine take care of that threat?

Admiral Reynolds. Because I think it is very clear to us that the Soviets will continue to improve their submarines.

Mr. AuCoin. Let's stay with this growth industry and those areas outside the Soviet Union that you identified as one of the reasons we need to fund the SSN-21.

What is it about that particular threat that requires us to move to an SSN-21 when the LA class seems to me to be adequate to meet that threat?

Admiral Reynolds. I think it is important to understand that if you were considering a high-low mix of capability, one set of submarines with a certain capability, another set with higher capability, I think it is clear that even our 637 Class submarines at sea today, for example, would be a match for a considerable portion of the submarine inventory around the world. Our 688 class submarine, as I earlier stated, is a match for Akula, but Akula will continue to improve.

Diesel-electric submarine capability——

Mr. AuCoin. I want to come back to that. Let's take one thing at a time.

The first question is outside the Soviet threat in these other countries that may be developing submarine capability, isn't it true that the LA class sub is more than a match for any submarine that exists in that category?

Admiral Reynolds. Yes.

SOVIET SUBMARINE THREAT

Mr. AuCoin. So I would not then, Mr. Chairman, just for the record, I would not as one Member of this committee regard that as a particular argument for building the SSN-21s, when we are pressed as we are to look for savings. I would take that argument off the table.

In terms of the Soviet threat, you told the Chairman that the Akula class is the Soviets' best foot forward; is that correct?

Admiral Reynolds. Yes, sir.

Mr. AuCoin. And you indicated that the LA class, however, is superior to it.

Admiral Reynolds. Our best SSN-688s are better than their Akula.

Mr. AuCoin. That then leads to what I cut you off on, and that was I think a description of what you are worried about in terms of how the Soviets might improve the Akula to somehow make it superior to the LA class. Tell me about that.

Admiral Reynolds. Yes, sir, I will be happy to.

Mr. AuCoin. Right now there is no question that the LA class submarine in our arsenal is superior to the Akula?

Admiral Reynolds. Correct. Our best SSN-688s—we have a spectrum of ships.

Mr. AuCoin. Short of the SSN-21.

Admiral Reynolds. In 1989, the Soviet Union launched nine submarines so they are not abating their building or development program.

Mr. AuCoin. How many Akulas have they launched?

Admiral Reynolds. A total of five.

Mr. AuCoin. What are those nine—nine classes or nine ships?

Admiral Reynolds. Nine hulls that included strategic ships and missile launchers.

Mr. AuCoin. Five are Akulas?

Admiral Reynolds. No, sir. They have launched five Akulas to date total.

Mr. AuCoin. Of those nine, how many are Akulas?

Admiral Reynolds. I would have to check.

Mr. AuCoin. Are any?

Admiral Reynolds. I believe two.

Mr. AuCoin. Two Akulas, and what is the nature of your concern about the Akulas, since they are inferior now against our best class, the LA submarine?

Admiral **Reynolds**. The Akula Class—like any major class ship, I view it as a system—it is almost like a truck. It carries weapons, sensors and people. The sensors, for example, and the machinery of the ship will undergo scrutiny with time and the Soviets will continue to improve that ship; we should improve our ships as well.

So as we have tracked every class of Soviet submarine over the years, they have continued to improve the submarines as technology and development allows. I think it is clear that they will continue to do that with Akula and any follow-on class to Akula.

Mr. **AuCoin**. So what you are describing is a fairly well-documented history that the Soviets don't remain static in their capability; they grow their capability and improve their capability, and within existing classes of ships; is that correct?

Admiral **Reynolds**. They improve them by specific classes of ships and they add new classes of ships at a considerable rate as well.

Mr. **AuCoin**. So you have history behind you when you say you are concerned about the improvement in terms of sensors, et cetera, for the Akula class?

Admiral **Reynolds**. Yes, sir.

IMPROVEMENT TO LOS ANGELES CLASS SUBMARINES

Mr. **AuCoin**. Why is there reason to believe that the LA class could not be improved in a similar way? You have already referred to an order of magnitude improvement in the LA class. Why should we remain static? Why can't we forego the SSN-21 and rely on improvement to the LA class?

Admiral **Reynolds**. The reason is that the LA class is 20 years old and we have done exactly what you say. The ship has improved. That is why I alluded to the 688-I with improved weapons capability.

But we have reached the limit of growth on the 688 Class for sheer technical reasons and Admiral Hekman can probably address that better than I, but there is no room for growth.

Mr. **AuCoin**. Are you talking about volume?

Admiral **Reynolds**. Weight and volume, sir.

Mr. **AuCoin**. Compare that to the weight and volume of the Akula. Does it have more volume?

Admiral **Reynolds**. It is a 10,000-ton submarine.

Mr. **AuCoin**. What is the LA class?

Admiral **Reynolds**. About 7,000 tons, sir.

Mr. **AuCoin**. In terms of volume——

Admiral **Reynolds**. The SSN-21 will be 9,150 tons.

Mr. **AuCoin**. In terms of volume——

Admiral **Reynolds**. I am glad you mentioned that because the weight describes the volume. From an acoustic standpoint, size has a lot to do with your ability to quiet a submarine. The machinery is rotating machinery and pumps and valves and the physics of the situation is such that you need considerable volume in order to do sound quieting, everything from the use of hangars on pipes to the way you put the bed plates, et cetera, that support the machinery.

I think the reason that we have seen in the Soviet Union, the growth, the size of their submarines, is their attempt to provide margin to, first, quiet the ship as best they can with today's technology, and to provide growth for the future. The Typhoon class, their most modern strategic ship, is a 27,500-ton ship.

SOVIET SUBMARINE THREAT

Mr. **AuCoin**. Coming back to Akula, how many years behind our best attack submarine would you say their technology and capability is?

Admiral **Reynolds**. I think it is different, depending on whether you are looking at weapons, sound quieting or hull fabrication. There is a cornucopia of technology from fire control systems to quieting.

I think it would be very difficult to put the whole class of ships so many years behind us. I think it is very technically documentable, however, that the gap we enjoyed in the past, we made up with technology the difference in force structure. In other words, they always have more——

Mr. **Cann**. I would like to make a comment. I have been personally following ASW for a long, long time. We estimated what was going to happen and when, and invariably we are wrong.

However, the one thing that has been a big surprise is the rapidity with which the Soviets finally got on top of the submarine quieting business. I have to go back into history for a minute.

I was involved in large studies, before I was in the government the first time, on this subject. We projected that about the time the Yankee came out, they were going to have a very quiet submarine comparable to ours. They didn't, so a lot of credibility was lost in the community.

Along about 1980 or 1981, we began to see really big changes in the Soviet quieting business with the Victor III and the subsequent Akula. I think on their side, it depends on their intent and on affordability. They know what to do. I don't think anybody would question that they know what to do if they want to build a very quiet submarine.

Mr. **AuCoin**. It is a question of affordability. The same problem we have?

Mr. **Cann**. Of course. But they see the importance of their ability to defend their strategic submarines and what they need to do for that.

Mr. **AuCoin**. Mr. Chairman, I have a couple more questions I would like to ask.

Mr. **McDade**. Would you yield?

Mr. **AuCoin**. I have been keeping a clock, Mr. Chairman. I have used half the amount of time the gentleman from Washington has. I would be delighted to yield the robust amount of time I have left.

Mr. **McDade**. I want to pursue this with you because it is a matter of great interest to all of us.

How long did we underestimate—how wrong was the official estimate about the quieting capability in the Akula? We projected that they were going to get to a point and they got to it a lot faster than we had projected.

Mr. **Cann**. I will have to give you the numbers for the record.

Mr. **McDade**. Put them in the record.

[Clerk's note.—Classified insert removed.]

Mr. McDade. Admiral, if you want to correct—what were our expectations and what happened?

Mr. Cann. Let's do it for the record.

Mr. McDade. I want to do something now.

Mr. Cann. I'm sorry. In 1977, I believe that was the date we saw some improvement when the Delta came out. That is when we expected to see major quieting. I misspoke before when I said the Yankee.

When the Delta came out, we expected to see the Delta as a big quieting program. It didn't happen and it was embarrassing. After that, the people who do projections and make measurements got conservative and, for the next three or four years, the implication was we didn't see any quieting going on.

The first time we had an inkling of improvements was when some of our submarine skippers came back and said, "These guys are really quiet." This was when Victor III came out, around 1980. Since about 1980, the realization of what has been going on started to hit the system. It was around 1983 that the SSN-21 program got started in terms of conceptual development.

Mr. McDade. Because of the emerging threat?

Mr. Cann. Yes.

Mr. McDade. We have a submarine that ———?

Admiral Reynolds. ———.

Mr. McDade. A submarine that can use low speed to position itself. The Akula is not a boomer, but it can get itself in a position at ——— which causes maybe a little heartburn. Is that a fair statement?

Admiral Reynolds. Yes, sir. That could happen if we allowed the situation to develop where we didn't move forward from the synergistic ASW situation that Secretary Cann previously described. The SSN-21 is a piece of the ASW picture, that includes a large number of other systems.

Mr. McDade. I heard testimony that the Soviets developed that titanium double hull ———.

Admiral Reynolds. ———.

Mr. McDade. I remember a lot of concerns here because of the different variety of systems they were putting out, different speeds, I forget how many different models of submarines they cranked out. They were across the spectrum. We are talking about one system, focusing on the Akula and not talking about they were developing ———.

Mr. Cann. One of the things we ought to provide for the record is our current estimate of what they are doing beyond the Akula.

Mr. McDade. They are into metallurgy, propulsion systems, ——— a panoply of things as we discussed this issue, and we should discuss it.

We have a lot of problems that we didn't get into much. We have limited amounts of time and some have to wait a long time to get recognized.

Mr. AuCoin. I have some very limited time, it is obvious.

My impression is the Akula does not have a titanium hull.

Mr. McDade. They produced titanium hulls.

Mr. **AuCoin**. I think they did in the case of the MIKE and it got sunk, but Akula doesn't have titanium. Is that correct?

Admiral **Reynolds**. Yes.

Mr. **McDade**. Is it operating?

Admiral **Reynolds**. Yes, sir, Alfa has a titanium hull and is operating.

Mr. **McDade**. It is an effective weapon?

Admiral **Reynolds**. Alfa is a fast, deep-diving submarine; ———.

Mr. **McDade**. Would you say that they were looking at the metallurgical characteristics rather than the quieting?

Admiral **Reynolds**. I think your point is very well taken. The Soviets have very aggressive technology enhancement programs across a wide spectrum.

Mr. **McDade**. Our record doesn't reflect that, though, as we discuss the SSN-21 and its ability to compete against the Akula. In the interest of time, put it in the record.

[Clerk's note.—Classified insert removed.]

NON-SOVIET SUBMARINE THREAT

Mr. **McDade**. You were talking about the 40 countries, did you say, that had diesels? The British are pretty good in ASW, aren't they?

Admiral **Reynolds**. Yes, sir.

Mr. **McDade**. I know they are as good as the LA class. But I remember when they got into the hassle in the Falklands with Argentina, the Argentines had a diesel boat ——— and they were trying to move the fleet to the Falklands ———.

Admiral **Reynolds**. The possibility that a submarine was lurking around from both sides had significant impact on the outcome of the engagement. The British nuclear submarines went there and after sinking the Belgrano, that was the end of their surface activity.

Mr. **McDade**. How old was the Argentine diesel?

Admiral **Reynolds**. They had been procured FMS and were more than 25 years old.

Mr. **McDade**. We still argue about exporting that technology from this country because of our fears that some of these folks can quiet a diesel even more than the current systems that are out there. Is that a fair statement?

Admiral **Reynolds**. We are very sensitive to any kind of submarine-quieting information getting out of this country.

Mr. **McDade**. The authorizing committee fought about whether or not we ought to permit that technology—West Germans or somebody wanted to build some copies and we stopped it, and it was based on the fear of quieting getting a little loose in the world on diesels.

Admiral **Reynolds**. We make up for force structure numbers. We will never be on parity with the rest of the world in arms, and we make up for that in technology. That technology gap is so important that we protect it by precluding the transfer of some information that would be very sensitive to our national security.

I would put nuclear power, submarine-quieting technology and strategic weapons into that category.

Mr. **McDade**. Thank you, Mr. Chairman.

Mr. **Dicks**. Mr. Young.

SOVIET SUBMARINE THREAT

Mr. **Young**. Thank you, Mr. Chairman.

Isn't it true that the Soviets are devoting a lot of their technological advancements on submarines, that they are really putting the pressure on there?

Mr. **Cann**. Could you repeat the question?

Mr. **Young**. Is it a fair statement that the Soviets are spending a lot of their technology money, their technology time in the field of submarines?

Mr. **Cann**. In submarine development?

Mr. **Young**. Right, submarine development, submarine technology enhancement.

Mr. **Cann**. It has been clear for some time that they are. They have proliferated different classes. They tend to build one or two to determine how they can enhance their capability, try them out, and move on to something different.

It has been a remarkable program over the years. I am sure you have seen graphs that show we started the 688 class in 1970 or thereabouts, and the SSN-21 is the first time we are going to a new submarine since 1970 in terms of design. They have, in the meantime, developed eight or ten classes.

Mr. **Young**. Isn't it also true that sometimes we are a little surprised by the state of their technology, the advancement of their technology beyond the point that we expected it to be?

Mr. **Cann**. Yes, sir, that is true. Just before you came in, I had a discussion on that subject relative to the fact that we were quite surprised by the improvements to the Victor III back before—around 1980 and subsequent changes in the Akula design.

The difficulty is to get reliable measurement data. Usually we don't really know what they have designed or are putting into the field until we see it. That is a real problem because we don't have the mechanism to gain this insight until it is actually out there.

Mr. **Young**. The Typhoon when it went into the water was a big surprise. I remember sitting here with witnesses claiming that until that boat went into the water, they had no idea that the Soviets were building that kind of a submarine.

Mr. **Cann**. Admiral Hekman?

Admiral **Hekman**. We knew they were building something and we knew it was probably strategic, but we did not have many details at all and were quite surprised when that boat was launched.

SSN-21

Mr. **Young**. The point that I am leading up to in this discussion of whether the SSN-21 is going to be needed to counter a new Soviet technology. We are already sure that the Soviets aren't developing right now a technology that would improve their Akula to the point where it is superior to our SSN-688. Is that a fair statement?

Mr. **Cann**. There is no question the United States has had the most dynamic submarine program in the world—no question about it—and with the foresight of the Congress, Admiral Rickover and others, we have built a nuclear submarine force that is unparalleled. A decision was made in the beginning of the U.S. submarine program to emphasize stealth. That was a critical decision, and it is clear that the Soviets took a long time to catch up.

I think they were looking at a slightly different problem. They didn't put as much of an emphasis on stealth because they were trying to use their submarines for a different reason.

Once they realized what we were doing, and ———, they began to put a lot of emphasis on the whole question of quietion. The thing that has kept us a viable maritime nation is not only submarines, but our willingness to invest in technology and our willingness to get it to sea.

The best example of that has been in the submarine program. The biggest issue with submarines is you don't know what they have done until you see it in the water, and it is too late then because the lead time is seven to ten years.

Mr. YOUNG. The point is, your response to Mr. AuCoin that the SNN-688 was superior to the Akula today, that could change the next time they put another boat in the water.

Mr. CANN. That is true.

NEW SOVIET SUBMARINES

Mr. DICKS. Is there any new class of Soviet submarine under construction?

Mr. CANN. I'll have to find out. I haven't had a chance to have an intelligence briefing. I've got to find out.

Mr. DICKS. Maybe one of the Admirals could answer this. Anything new?

Admiral REYNOLDS. ———.

Mr. DICKS. So Akula is their most modern attack submarine?

Admiral REYNOLDS. Yes, sir.

Mr. YOUNG. They build their submarines in closed facilities where we are unable to see what they are doing inside?

Mr. CANN. Yes. That is the problem.

TECHNOLOGY BASE

Mr. YOUNG. Mr. Chairman, I appreciate your responses to those questions. I have additional questions I would like to submit in writing.

My colleagues have heard them over and over again this year, and I don't want to bore them, but I would like to hear your response to these questions dealing with the general health of our total research and development capability, and in the future, and what it looks like.

I will submit that in writing.

Mr. Chairman, since Mr. Livingston is not able to be here because of another committee meeting, he would like to submit some questions also.

Mr. DICKS. So ordered.

[CLERK'S NOTE.—Questions submitted by Mr. Young and the answers thereto follow:]

Question. Mr. Cann, this Country's superior war fighting ability has provided deterrence to democracies here and elsewhere which in turn has been the major building block of the tremendous growth in Democracy and freedom in the Communist world. That war fighting capability is founded on the greatest Research and Development base available in the world. The irony is that now we are faced with an effort by some to dismantle a great part of the war fighting capability, the realities of which we can not ignore.

What really concerns me is what could happen to the private Research and Develoment base as we cut back on production of these weapons systems. Investors are becoming uneasy about the return on investment in the Defense Industry—they can make more elsewhere. Corporate raiders out to make a fast buck are common place in today's economy and much of our Defense Industry is vulnerable because many of these companies are worth more split up than they are as a team.

A lot of our country's R&D effort is visible—through your budget. But a lot of the R&D effort is not visible. The private sector invests a lot of its own profits into R&D hoping to recoup it in future production. But if that future production is not there, it could just as easily pay itself more in profits. If someone, not concerned about the future were to acquire a defense company, he might just pay himself instead of invest. If a foreigner, not concerned with this country's military capability, were to acquire a defense company, he could just reap profits instead of invest in R&D.

How do we keep these things from happening?

Answer. We cannot prevent a significant erosion of military-unique, private R&D, particularly the invisible portion as discussed below. However, there are several actions that we can take to minimize the impact:

We must strengthen the government-funded and conducted R&D (including facilities) which supports unique military long-term requirements:

As directed by the DMR, we must learn to make increased use of commercial products—encouraging their production where appropriate—to take advantage of the private R&D development that must continue if private industry is to remain competitive in the commercial world;

We must provide adequate dollars to fully fund those R&D programs we do undertake to reduce reliance on invisible, private funding;

We must search for incentives (such as dual use) for private investment in R&D; and

We must shift resources as required to provide a strong tech base for future production.

Question. What portion of real R&D is visible and what is not?

Answer. In FY 1989, the visible R&D, funded by the federal government, amounts to $63 billion, $38 billion of which is funded by DOD. The invisible R&D, represented by private sector investment, is estimated at $64 billion. (Science & Engineering Indicators—1989, National Science Board). The R&D base provided by industry is significant and its viability is crucial.

Question. How does IR&D enter into this picture (of corporate raiding and takeover, especially by foreign interests)?

Answer. IR&D, as defined by Federal law, is company sponsored, company selected research and development carried out by companies and corporation cost centers with significant business with DoD and NASA. It is viewed by DoD as a cost of doing business and thus the required funding is provided through the overhead on contracts (both DoD and non-DoD) and company profit contribution. IR&D is a small subset of the research carried on by corporate America; of the approximately $64 billion spent by American companies on self-funded reasearch and development, only about $5 billion was IR&D. The DoD share of this $5 billion was about $2 billion.

Corporate research, near-term focused though it is, would propably not increase the selling price of a corporate component. IR&D is only a small part of overall corporate research and this is not considered to be a major factor in corporate takeovers. As concerns foreign companies and IR&D, as of last year, foreign firms have begun direct involvement in IR&D. Three fully owned foreign firms, Smith Industries, BAE, and General Electric of Great Britian participate as do several American firms acquired by foreign investment.

Question. Are you concerned about the future of our technology base?

Answer. The technology base is currently faced with a number of significant threats: declining numbers of embarking and graduating scientists and engineers; obsolete and eroding plants, facilities and equipment; inadequate support exists for funding long term R&D to compensate for years of neglect of the tech base and for the loss of private investment and long term defense related R&D.

[CLERK'S NOTE.—End of questions submitted by Mr. Young. Questions submitted by Mr. Livingston and the answers thereto follow:]

Question. Mr. Secretary, Admirals, the National Science Foundation projects a shortfall of 560,000 scientists and engineers by 2010. Can you tell this Subcommittee how this human resource shortage impact the Navy's research programs, labs, and, more specifically, fundamental research (6.1 accounts) programs?

Answer. Currently the Navy is impacted by shortages in specialty areas such as electromagnetic propagation, ocean acoustics and ocean optics, structural acoustics and computer scientists; this situation is expected to worsen and extend to broader areas in the future.

Question. Please quantify for the record what shortages the Navy is experiencing in acquiring science and engineering graduate talent?

Answer. The in-house labs are experiencing real shortfalls in recruiting scientists in the following disciplines—underwater acoustics, structural acoustics and electromagnetic propagation (radar and optics), as well as Computer Scientists. National statistics show that Computer Science is one of the S&E fields with the highest reported level of shortages. Moreover, the top S&E graduates are going to industry and university, not to the Navy labs. As the pay discrepancy increases, this problem will worsen.

Question. What specific programs does the Navy have to address shortfalls in scientific and engineering personnel? Provide a breakout of programs by account and dollars as well as a brief explanation of each program.

Answer. The Navy has a spectrum of programs (under Program Element 0601153) ranging from pre-high school and high school to senior scientists that seek to actively attract people, responding to the increased need for scientific and engineering personnel. The Navy alone is not up to the whole task, but because of the nature of the nature of the Navy—focussed and fairly small—niches and specialization areas can be impacted. These programs are as follows:

[Fiscal year 1990]

	Millions
High School Apprenticeship Program (total)	$1.2
Naval Science Awards Program	.2
Naval Minority University Program	6.0
ONR Graduate Fellowship Program	4.1
National Defense Science & Engineering Graduate Fellowship Program (ONR portion)	4.42
ONR-NRC Postdoctoral Research Associates	.350
ONR Young Investigator Program	3.375
ONR Summer Faculty Research Program	2.4
Women Science Scholars Program	.233
Ocean Science Educators Awards	.375
ONT Postdoctoral Fellowship	.8

ONR HIGH SCHOOL APPRENTICESHIP PROGRAM

Each summer, the Office of Naval Research (ONR) supports activities aimed at encouraging high school students to consider careers as scientists or engineers. ONR funds students working on research projects under the guidance of ONR principal investigators at universities, and funds the placement of high school students in Navy laboratories for hands on research in the summer.

NAVAL SCIENCE AWARDS PROGRAM

The Naval Science Awards Program was established in 1958 as a means to stimulate and reward scientific achievement among high school students by encouraging them to develop their interests in science and engineering and to pursue scientific or technical careers. Awards are made competitively in response to science fair projects at local, state, regional, and international levels.

NAVAL MINORITY UNIVERSITY PROGRAM

The Historically Black Colleges (HBC) Council is an officially established ONR council whose primary purpose is to facilitate interactions between HBC institutions and ONR that may lead to greater HBC participation in the ONR Research Programs Department (RPD). A major effort directed at undergraduate education was initiated in FY1989 with the long term view to increase numbers and quality of HBC graduate students in science and engineering. In addition, research efforts continue through grant awards.

ONR GRADUATE FELLOWSHIP PROGRAM

The ONR Graduate Fellowship Program is designed to increase the supply of U.S. citizens trained in science and engineering disciplines critical to the Navy. ONR awards approximately 50 new fellowships per year to recent outstanding graduates to support study and research leading to doctoral degrees in the disciplines specified. The program began in FY1982 and has made 360 appointments to date. ONR pays full tuition, required fees, stipends, and departmental allowances.

NATIONAL DEFENSE SCIENCE AND ENGINEERING GRADUATE FELLOWSHIP PROGRAM

This is a Department of Defense program via ONR, the Army Research Office, the Air Force Office of Scientific Research, and the Defense Advanced Research Projects Agency. This program awards 125 new fellowships annually for students at or near the beginning of graduate study. The stipends are $15,000, $16,000, $17,000 plus full tuition and fees plus $2,000 department allowance. The program began in FY1989; to date, 41 of the 122 awardees "belong" to ONR.

ONR–NRC POSTDOCTORAL RESEARCH ASSOCIATES

The purpose of this program is to provide investigators of unusual ability and promise with an opportunity for research experience in basic and applied research of great interest to the U.S. Navy. This program is designed to enhance the exchange of scientific knowledge between universities and the U.S. Navy laboratories and centers. Thirty appointments are made annually, covering the physical, ocean, and engineering sciences.

ONR YOUNG INVESTIGATOR PROGRAM

The objectives of this program, which is a component of the Navy University Research Initiative Program, are to attract to naval research outstanding young university faculty members, to support their research, and to encourage their teaching and research careers. ONR makes approximately 15 new awards annually to academic researchers who have held a PhD or equivalent degree for less than 5 years. This program began in FY 1985. Awards are for three years.

ONR SUMMER FACULTY RESEARCH PROGRAM

During the summers, science and engineering faculty members from universities and colleges spend 10 weeks conducting research at Navy research and development centers. Participants work with professional peers in the Navy centers on research tasks of mutual interest. There are 200 faculty participants at 19 labs annually. The program began in FY 1979. Participants total 1,250 as of summer 1989.

WOMEN SCIENCE SCHOLARS PROGRAM

The Women Sciences Scholars Program, begun in FY 1980, is a program that supports 6 postdoctoral women scientists annually.

The program provides $25,000 stipends plus lab and administrative fees to women scientists at the Mary Ingraham Bunting Institute of Radcliffe College. This opportunity is designed to equip participants with state-of-the-art experiences to increase competitiveness for tenure, promotions, etc. As of FY 1990, there have been 38 appointments.

OCEAN SCIENCE EDUCATORS AWARDS

The Ocean Science Educators Awards program supports academic ocean scientists who will draw postdocs from other disciplines into ocean science. The awards are based on the institution's commitment to ocean sciences, the ocean scientist's credentials, and the postdoc's achievements. Three new awards are given annually, intended to consist of 3-year grant awards at $75,000/yr. The program, which began in 1990, has given 5 awards to date.

OFFICE OF NAVAL TECHNOLOGY (ONT) POST DOCTORAL FELLOWSHIP PROGRAM

This program is funded under PE 0602936 at a rate of $800,000 annually. The program provides support for the first-year appointments of 15 new Postdoctoral Fellows and the basic program administration. Additional funds (about $1.2 million) are provided annually by the host laboratories to support about 25 additional first-year appointments and all reappointments for the second and third years of research. Research topics currently being pursued include those fields of physics, chemistry and mechanical engineering, among others. At present there are about 70 Fellows conducting research at fourteen Navy labs/R&D centers and the Naval Academy.

Question. Does the Navy have graduate traineeship or fellowship programs for science and engineering? Provide details on funding and accounts that these programs fall under. If not, explain why.

Answer. Through grants of the Research Programs Department, approximately 4,000 graduate students at over 300 institutions are directly supported in total as participants in research efforts. In addition, the Navy has several programs that actively respond to the increased need for graduate scientific and engineering personnel. They are as follows:

[Fiscal year 1990]

	Millions
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Question. Provide for the record a breakout by state, university, number and dollars the fellowships in science, engineering, and other areas that the Navy has provided in each of the last five fiscal years.

Answer. The information follows:

ONR GRAD FELL-EXCEL

SUMMARY OF EXPENDITURES

PROGRAM EXPENSES	NUMBER OF FELLOWS	PARTICIPANT SUPPORT	TOTAL PROGRAM COST	AVERAGE COST/ FELLOW
FY1986 PROGRAM	141	$3,387,503.18	$3,569,087.33	$24,024.85
FY1987 PROGRAM	153	$3,854,571.24	$4,074,004.39	$25,193.28
FY1988 PROGRAM	133	$3,631,448.79	$3,721,204.80	$27,304.13
FY1989 PROGRAM	125	$3,667,984.96	$3,909,209.85	$29,343.88
FY1990 PROGRAM	138	$1,198,614.90*	$1,294,393.66*	

* FROM 1 OCTOBER 1989 THRU 28 FEBRUARY 1990

ONR FELLOWS

ONR GRADUATE FELLOWS SUPPORTED BY FY

STATE	UNIVERSITY	NUMBER OF FELLOWS FY86	FY87	FY88	FY89	FY90
ARIZONA						
	ARIZONA STATE U.	1	1	1	1	1
	U. OF ARIZONA			1	2	2
CALIFORNIA						
	CAL INST TECH	6	7	6	7	8
	U. OF CAL/BERKELEY	4	4	5	6	12
	U. OF CAL/IRVINE	1	1			
	U. OF CAL/LOS ANGELES	2	1			
	U. OF CAL/SAN DIEGO			1	3	4
	U. OF CAL/SANTA BARBARA	1	1			
	U. OF SOUTHERN CAL	2	2			2
	STANFORD U.	19	19	16	16	16
	SCRIPPS INSTITUTION	1	2	2	1	1
COLORADO						
	COLORADO SCHOOL OF MINES	1	0			
	U. OF COLORADO/BOULDER	1	0	1		
CONNECTICUT						
	YALE U.				1	
DELAWARE						
	U. OF DELAWARE	2	2	1	1	3
FLORIDA						
	FLORIDA ATLANTIC	1	1	1		
	FLORIDA STATE U.	1	2	2	2	
	U. OF SOUTH FLORIDA	1	1			
GEORGIA						
	ATLANTA U.			2	3	3
	GEORGIA TECH			2	3	4
ILLINOIS						
	NORTHWESTERN	3	2			
	U. OF CHICAGO			1	1	2
	U. OF ILLINOIS/URBANA	8	7	4	5	4

ONR FELLOWS

STATE	UNIVERSITY	NUMBER OF FELLOWS FY86	FY87	FY88	FY89	FY90
INDIANA						
	PURDUE U.	1	1			
	U. OF INDIANA/BLOOMINGTON		1	1		1
LOUISIANA						
	TULANE U.					1
KENTUCKY						
	U. OF KENTUCKY			1	1	1
MASSACHUSETTS						
	HARVARD	3	7	8	7	4
	MIT	21	26	22	25	30
	WOODS HOLE INSTITUTION	1	1	2	1	2
MARYLAND						
	JOHNS HOPKINS U.	1	1	1	1	
	U. OF MARYLAND	2	2	1	1	1
MICHIGAN						
	MICHIGAN TECHNOLOGICAL U.	1	1			
	U. OF MICHIGAN	2	1			1
MINNESOTA						
	U. OF MINNESOTA	1	1	1	1	1
MISSISSIPPI						
	U. OF MISSISSIPPI	2				
	MISSISSIPPI STATE U.		2	1	1	
MISSOURI						
	U. OF MISSOURI/COLUMBIA	1	1	1		
	U. OF MISSOURI/ROLLA		1	1	1	1
NEW HAMPSHIRE						
	DARTMOUTH COLLEGE	2	1	1	2	2
NEW JERSEY						
	PRINCETON U.		3	6	6	5

ONR FELLOWS

STATE	UNIVERSITY	NUMBER OF FELLOWS FY86	FY87	FY88	FY89	FY90
NEW YORK						
	COLUMBIA U.	4	4	2		
	CORNELL U.	6	7	6	2	2
	COURANT INSTITUTE	2	1			1
	MOUNT SINAI SCHOOL OF MEDICINE				1	1
	RENSSELAER POLYTECH INST	2	3	1	1	
	SUNY/ STONEY BROOK	1	1			
	U. OF ROCHESTER	1	1	1	3	4
	NYU			1		
NORTH CAROLINA						
	DUKE U.	2	1			
	NORTH CAROLINA ST. U.	1	1			1
	U. OF N. CAROLINA/CHAPEL HILL		1	1	1	
OHIO						
	OHIO STATE U.	1	1		2	2
OKLAHOMA						
	OKLAHOMA STATE U.	1	1			
PENNSYLVANI						
	CARNEGIE-MELLON U.	6	4	5	4	4
	DREXEL U.	1				
	LEHIGH U.	1	1	1		
	PENN STATE U.	2	1	1	2	1
	TEMPLE U.					1
	U. OF PENN	1	2	1		1
RHODE ISLAND						
	BROWN U.		1	1	1	
TENNESSEE						
	VANDERBILT U.	2	2	1		

ONR FELLOWS

TEXAS						
	U TEXAS/ ARLINGTON	1	1	1		
	U. TEXAS/ AUSTIN	2	2	1		1
UTAH						
	U. OF UTAH	1	1	1		
			NUMBER OF FELLOWS			
STATE	UNIVERSITY	FY86	FY87	FY88	FY89	FY90
VIRGINIA						
	VPI & STATE U.	1	3	3	2	1
	U. OF VIRGINIA	1	1	1	1	
WASHINGTON						
	WASHINGTON ST. U.	1				
	U. OF WASHINGTON	4	5	6	4	5
WISCONSIN						
	U. OF WISCONSIN/MADISON	3	4	5	2	1
	TOTALS	**141**	**153**	**133**	**125**	**138**

ONR NDSEG FELLOWS

ONR/NDSE GRADUATE FELLOWS SUPPORTED BY FY

STATE	UNIVERSITY	NUMBER OF FELLOWS FY89
CALIFORNIA		
	U. OF CAL/BERKELEY	4
	U. OF CAL/IRVINE	1
	U. OF CAL/LOS ANGELES	2
	U. OF CAL/SAN DIEGO	4
	STANFORD U.	3
COLORADO		
	U. OF COLORADO/BOULDER	1
CONNECTICUT		
	U. OF CONNECTICUT	1
MASSACHUSETTS		
	BOSTON U.	1
	HARVARD	2
	MIT	6
	WOODS HOLE INSTITUTION	1
MARYLAND		
	JOHNS HOPKINS U.	1
MICHIGAN		
	U. OF MICHIGAN	1
MISSOURI		
	U. OF MISSOURI/ROLLA	1
NEW YORK		
	COLUMBIA U.	1
	NYU	1
NORTH CAROLINA		
	DUKE U.	1
	NORTH CAROLINA ST. U.	1
PENNSYLVANI		
	CARNEGIE-MELLON U.	2
	U. OF PENN	1
RHODE ISLAND		
	BROWN U.	1
WASHINGTON		
	U. OF WASHINGTON	1
	TOTAL	**38**

Question. If additional funding were made available to the Navy, would it make sense and be helpful to future Navy research efforts to implement graduate science and engineering traineeship programs that would develop a broader national base for science and engineering talent?

Answer. ONR research grants already directly (and wholly) support more than 4,000 graduate students annually. Should additional funds for training in science and engineering become available, ONR would increase its investment in graduate students as participants in research grants and/or support more Fellowships.

Question. What is the geographic distribution of the Navy's URI and URI-RIP programs awards? Provide this data by state and institution, including the number of awards by each state and institution and the dollar value breakout for each.

Answer. The information follows:

1987-1989 URI Support to Educational Institutions

State	SCC	Contractor	1987	1988	1989
AL	tuit	Tuskegee Institute	0.00	404100.00	270000.00
	Total for AL :		0.00	404100.00	270000.00
AZ	arzu	University of Arizona	50561.00	50597.00	0.00
	Total for AZ :		50561.00	50597.00	0.00
CA	cait	California Institute of Technology	326205.00	32621.00	216775.00
CA	caib	The Regents of the University of California	100000.00	13126.00	0.00
CA	calj	The Regents of the University of California	567390.00	1258803.00	600000.00
CA	call	The Regents of the University of California	75000.00	441817.00	684093.00
CA	calr	University of California, Santa Barbara	266190.00	909000.00	597814.00
CA	cals	University of California, San Diego	0.00	0.00	50000.00
CA	caut	California State University	108597.00	0.00	0.00
CA	sclu	University of Southern California	125987.00	502980.00	692000.00
CA	sjss	San Jose State University Foundation	0.00	0.00	26136.00
CA	stnf	Leland Stanford Junior University	50000.00	0.00	14000.00
	Total for CA :		1619369.00	3158347.00	2880818.00
CO	clrb	University of Colorado	0.00	50000.00	0.00
CO	ntuc	National Technological University	0.00	179600.00	100000.00
	Total for CO :		0.00	229600.00	100000.00
CT	yale	Yale University	0.00	0.00	52323.00
	Total for CT :		0.00	0.00	52323.00
DC	amse	American Society for Engineering Education	1510000.00	700000.00	2294000.00
DC	cath	Catholic University of America	0.00	0.00	235000.00
	Total for DC :		1510000.00	700000.00	2529000.00
FL	flab	Florida Atlantic University	0.00	0.00	139000.00
FL	fsut	Florida State University	200000.00	200000.00	200000.00
	Total for FL :		200000.00	200000.00	339000.00
IA	isua	Iowa State University	0.00	0.00	123000.00
	Total for IA :		0.00	0.00	123000.00
IL	chgu	The University of Chicago	110000.00	50000.00	50000.00
IL	iluh	University of Illinois at Urbana	138521.00	2353897.00	1680237.00
IL	nwue	Northwestern University	50000.00	50288.00	0.00
	Total for IL :		298521.00	2454185.00	1730237.00
IN	purd	Purdue Research Foundation	50000.00	681919.00	500000.00
	Total for IN :		50000.00	681919.00	500000.00
MA	detb	Office of Naval Research Detachment, Boston	6772.00	0.00	0.00

1987-1989 URI Support to Educational Institutions

State	SCC	Contractor	1987	1988	1989
MA	hrvc	Harvard College	159635.00	0.00	32390.00
MA	mass	University of Massachusetts	183500.00	523600.00	511100.00
MA	masv	University of Massachusetts Medical Center	0.00	0.00	39017.00
MA	mitc	Massachusetts Institute of Technology	554887.00	1696000.00	1705300.00
MA	neub	Northeastern University	0.00	0.00	50000.00
MA	whoi	Woods Hole Oceanographic Institution	647703.00	1695400.00	1973708.00
		Total for MA :	1552497.00	3915000.00	4311515.00
MD	mrya	University of Maryland	0.00	925883.00	774214.00
MD	mryb	University of Maryland	341325.00	0.00	0.00
		Total for MD :	341325.00	925883.00	774214.00
MI	mich	Regents of the University of Michigan	386945.00	1033178.00	858262.00
MI	wnsd	Wayne State University	0.00	0.00	143000.00
		Total for MI :	386945.00	1033178.00	1001262.00
MN	mind	University of Minnesota	60000.00	50000.00	50000.00
		Total for MN :	60000.00	50000.00	50000.00
MO	wasl	Washington University	0.00	0.00	146000.00
		Total for MO :	0.00	0.00	146000.00
MS	miss	University of Mississippi	0.00	0.00	160000.00
		Total for MS :	0.00	0.00	160000.00
NC	duke	Duke University	10000.00	57243.00	0.00
NC	ncat	North Carolina A&T State University	0.00	404100.00	245000.00
NC	ncst	North Carolina State University	776878.00	295306.00	800000.00
NC	ncuc	University of North Carolina at Chapel Hill	219144.00	1109030.00	835070.00
		Total for NC :	1006022.00	1865679.00	1880070.00
NH	dart	Dartmouth College	341536.00	1061849.00	1053498.00
		Total for NH :	341536.00	1061849.00	1053498.00
NJ	prnc	Princeton University	0.00	0.00	17100.00
		Total for NJ :	0.00	0.00	17100.00
NY	ccmp	Columbia Univ. in the City of New York	692324.00	290240.00	893908.00
NY	rocr	University of Rochester	171818.00	144918.00	50000.00
		Total for NY :	864142.00	435158.00	943908.00
OH	csws	Case Western Reserve University	0.00	52086.00	0.00
OH	osrc	Ohio State University Research Foundation	50000.00	50000.00	0.00

1987-1989 URI Support to Educational Institutions

State	SCC	Contractor	1987	1988	1989
		Total for OH :	50000.00	102086.00	0.00
OR	orsc	Oregon State University	1192910.00	1701410.00	1583958.00
OR	orus	University of Oregon	110000.00	64502.00	66996.00
		Total for OR :	1302910.00	1765912.00	1650954.00
PA	crng	Carnegie-Mellon University	182685.00	718400.00	584600.00
PA	drxu	Drexel University	0.00	0.00	81000.00
PA	penp	University of Pennsylvania	0.00	0.00	25400.00
PA	psuh	Pennsylvania State University	135568.00	0.00	0.00
PA	psus	Pennsylvania State University	236826.00	1200931.00	1147523.00
PA	psuu	The Pennsylvania State University	0.00	662724.00	718711.00
		Total for PA :	555079.00	2582055.00	2557234.00
RI	brwn	Brown University	5081.00	10590.00	26545.00
RI	rhis	University of Rhode Island	136002.00	0.00	0.00
		Total for RI :	141083.00	10590.00	26545.00
SC	clem	Clemson University	0.00	592957.00	200000.00
SC	scru	University of South Carolina	0.00	0.00	99920.00
		Total for SC :	0.00	592957.00	299920.00
TX	rice	Rice University	0.00	0.00	30000.00
TX	texs	University of Texas	49980.00	906322.00	260187.00
		Total for TX :	49980.00	906322.00	290187.00
VA	gmaf	George Mason University	0.00	0.00	96000.00
VA	vapi	Virginia Polytechnic Institute & St. Univ.	0.00	0.00	10200.00
VA	vauc	University of Virginia	0.00	186869.00	57700.00
		Total for VA :	0.00	186869.00	163900.00
WA	wapi	University of Washington	0.00	722576.00	528315.00
WA	waus	University of Washington	50000.00	60138.00	0.00
WA	wsup	Washington State University	0.00	0.00	127000.00
		Total for WA :	50000.00	782714.00	655315.00
WI	wisc	University of Wisconsin	50000.00	0.00	0.00
		Total for WI :	50000.00	0.00	0.00
WV	wvum	West Virginia University	110000.00	50000.00	70000.00
		Total for WV :	110000.00	50000.00	70000.00
		Grand Total:	10589970.00	24145000.00	24576000.00

Question. Provide a breakout in number and dollar value, and by state and institution, the basic research or 6.1 program grants or awards made by the Navy to private or public entities for fiscal years 1987, 1988 and 1989.

Answer. The information follows:

CODE 11 and CODE 12 OBLIGATIONS FOR THE PERIOD 1987-1989
ACTUAL DOLLARS

STATE	CONTRACTOR	FY 1987	FY 1988	FY 1989	# AWARDS
FOREIGN		3,451,617	3,591,879	4,655,350	162
ALASKA		175,620	164,868	193,200	11
ALABAMA		510,737	528,674	444,891	16
ARKANSAS		214,495	160,609	203,574	4
ARIZONA		1,946,189	2,005,801	1,542,014	60
CALIFORNIA		46,296,954	42,897,068	46,910,702	1139
COLORADO		2,901,826	3,434,224	2,599,793	107
CONNECTICUT		2,542,916	2,553,179	2,472,750	91
DISTRICT OF COLUMBIA		3,397,671	4,621,459	7,486,426	83
DELAWARE		1,055,040	632,891	548,186	27
FLORIDA		5,433,870	6,046,079	5,608,302	134
GEORGIA		2,805,019	2,890,734	3,817,708	96
HAWAII		953,901	1,649,482	1,909,577	28
IOWA		1,333,815	1,331,642	1,227,095	46
IDAHO		0	37,917	91,833	3
ILLINOIS		7,866,219	9,809,546	9,141,969	258
INDIANA		2,416,919	2,579,679	2,184,148	95
KANSAS		405,413	399,747	528,989	23
KENTUCKY		148,987	171,169	216,939	10
LOUSIANA		1,080,091	958,244	1,502,771	40
MASSACHUSETTS		26,525,241	28,452,913	30,083,740	548
MARYLAND		6,274,299	6,019,424	5,625,683	221
MAINE		647,334	513,970	612,201	22
MICHIGAN		2,614,353	3,117,838	3,340,577	105
MINNESOTA		930,948	1,280,288	1,026,319	38
MISSOURI		560,106	917,084	686,728	34
MISSISSIPPI		480,415	490,688	563,888	21
MONTANA		189,315	148,474	224,865	10
NORTH CAROLINA		3,547,091	2,911,974	3,283,734	115
NEBRASKA		372,302	120,370	115,745	7
NEW HAMPSHIRE		317,446	112,720	369,192	13
NEW JERSEY		3,593,854	2,895,473	3,060,622	107
NEW MEXICO		1,039,090	386,283	693,000	22
NEW YORK		16,322,033	17,396,440	15,773,022	477
OHIO		2,857,045	3,076,827	3,115,663	99
OKLAHOMA		210,322	312,708	197,000	9
OREGON		2,876,158	4,573,958	4,540,153	68
PENNSYLVANIA		12,433,553	11,023,180	12,547,190	341
PUERTO RICO		134,869	184,869	314,869	7
RHODE ISLAND		4,511,904	4,258,152	4,075,541	91
SOUTH CAROLINA		209,251	167,286	166,855	14
TENNESSEE		1,130,005	1,782,160	1,424,921	42
TEXAS		6,473,427	6,868,722	7,395,434	247
UTAH		1,409,606	1,173,703	1,099,854	36
VIRGINIA		4,205,363	3,049,259	4,120,383	129
VERMONT		30,000	44,658	75,000	3
WASHINGTON		8,884,927	10,942,945	12,266,113	149
WISCONSIN		947,368	1,778,568	1,575,026	55
WEST VIRGINIA		0	124,559	69,269	4
WYOMING		283,762	436,972	608,149	10
	GRAND TOTAL OBLIGATIONS:	194,946,686	201,027,355	212,336,953	5477

The remaining basic research funds are distributed to Navy and other Federal government in-house research laboratories.

CODE 11 and CODE 12 OBLIGATIONS FOR THE PERIOD 1987-1989 23-Apr-90
ACTUAL DOLLARS

STATE	CONTRACTOR	FY 1987	FY 1988	FY 1989
Foreign Obligations:				
	AERE Harwell	30,000	0	0
	Intera Technologies Ltd.	246,500	0	0
	University of Basel	16,000	0	0
	University of British Columbia	50,500	104,149	227,160
	Ben Gurion University of the Negev	0	0	55,000
	Bureau of Meteorology Research Centre	0	0	148,000
	British Marine Technology, LTD	0	0	50,000
	University of Bergen	150,000	159,000	250,000
	Canada Centre for Inland Waters	0	100,700	134,500
	University of Cambridge	105,160	104,390	80,105
	Coastal & Marine Engineering Research Institute	0	49,400	49,400
	University of Copenhagen	40,000	56,000	25,000
	Centro Ramon y Cajal	58,770	0	0
	Dalhousie University	85,052	135,105	249,331
	University of Erlangen-Nurnberg	0	7,000	0
	University of Essex	58,169	45,000	60,000
	University of Guelph	75,000	299,865	349,078
	Imperial College of Science and Technology	83,900	0	99,200
	Institute of Ocean Sciences	293,250	364,700	470,972
	Institute of Oceanographic Sciences	659,570	129,491	0
	Christian-Albrechts-Universitat	55,000	40,000	40,000
	University of Liege	0	0	8,000
	Max-Planck Institute for Meteorology	33,062	48,900	50,400
	McGill University	100,725	110,850	246,658
	Monash University	87,154	193,246	205,000
	Natuarl Environment Research Council	0	69,800	113,049
	Netherlands Org. for Applied Scientific Research	46,000	47,000	0
	University of New South Wales	15,000	0	0
	Newcastle Upon Tyne University	0	59,730	45,000
	Oxford University	69,349	144,054	151,560
	Riso National Laboratory	0	0	4,900
	Ruhr-Universitat Bochum	0	0	58,388
	University of Salford	40,000	0	0
	University of Saskatchewan	29,188	100,111	40,853
	University of Cambridge	0	115,511	144,374
	University of Southampton	140,000	90,000	100,000
	Standard Telecommunication Laboratories Ltd	90,000	211,000	201,000
	University of Strathclyde	41,790	67,807	69,377
	Tel-Aviv University	0	0	106,762
	Dr. Ivan Tolstoy	38,831	38,832	38,832
	TopExpress Limited	200,000	191,650	270,000
	University of Toronto	149,207	121,837	214,900
	University College	50,536	0	0
	Universite de Lausanne	67,000	33,000	30,000
	University of Waterloo	63,062	66,134	69,441
	Weizmann Institute of Science	87,900	157,096	104,344
	University of Western Ontario	15,942	45,521	38,766
	York University	80,000	85,000	56,000
	Total Foreign:	3,451,617	3,591,879	4,655,350

U.S. Obligations:

State: Alaska

AK	University of Alaska	175,620	164,868	193,200
	Total for AK:	175,620	164,868	193,200

State: Alabama

AL	Alabama A & M University	49,992	22,782	54,995
AL	Auburn University	67,965	0	0
AL	University of Alabama	233,338	244,782	224,098
AL	University of Alabama	71,829	96,395	45,711
AL	University of Alabama	42,613	0	0
AL	University of South Alabama	0	124,032	120,087
AL	Tuskegee Institute	45,000	40,683	0
	Total for AL:	510,737	528,674	444,891

State: Arkansas

AR	University of Arkansas	0	0	61,072
AR	University of Arkansas	214,495	160,609	142,502
	Total for AR :	214,495	160,609	203,574

State: Arizona

AZ	Arizona State University	1,373,369	1,191,655	681,895
AZ	University of Arizona	572,820	814,146	860,119
	Total for AZ :	1,946,189	2,005,801	1,542,014

State: California

CA	Aerojet Electro Systems	59,148	0	0
CA	The Agouron Institute	360,187	0	150,000
CA	Aquanautics Corporation	76,850	0	65,878
CA	California Research & Technology Inc.	0	0	150,535
CA	Aerojet Solid Propulsion	0	240,000	200,811
CA	California Institute of Technology	3,686,304	2,846,312	3,838,248
CA	University of California, Berkeley	5,553,755	3,227,477	3,987,381
CA	University of California, Davis	275,917	232,485	314,537

CA	The Regents of the University of California	0	66,568	67,673
CA	University of California, Irvine	2,097,943	1,341,284	1,427,957
CA	University of California San Diego, Scripps	6,447,359	1,273,408	5,701,805
CA	University of California, Los Angeles	3,070,396	2,671,259	3,414,229
CA	University of California, Santa Barbara	3,628,076	2,900,849	2,716,890
CA	University of California, San Diego	1,851,684	7,114,665	4,735,182
CA	University of California, Riverside	213,216	289,962	403,457
CA	University of California, Santa Cruz	495,658	902,079	1,123,270
CA	California State College	49,000	0	0
CA	University of California	2,172,949	2,698,849	1,409,418
CA	California State University Foundation	39,000	0	0
CA	Fluorochem Incorporated	198,662	126,678	124,276
CA	GA Technologies	100,000	0	0
CA	Helicon Foundation	119,522	180,754	60,000
CA	Dr. Robert D. Hill	43,000	45,000	0
CA	Hughes Aircraft Company	137,649	80,000	82,303
CA	International Business Machine Research Lab.	737,890	453,143	618,618
CA	International Computer Science Institute	0	0	112,500
CA	Institute of Ocean Sciences	0	101,000	0
CA	Institute for Research on Learning	0	0	149,826
CA	IWG Corporation	0	0	59,332
CA	Jortner Research Engineering	50,000	12,476	49,998
CA	Kestrel Institute	155,918	137,531	0
CA	Kestrel Institute	0	7,500	147,571
CA	Yuan T. Lee	0	250	0
CA	La Jolla Institute	106,898	328,804	487,268
CA	Lockheed Aircraft Corporation	393,010	0	0
CA	Lockheed Missiles & Space Company, Inc.	555,521	1,069,412	386,290
CA	Loma Linda University	30,260	0	0
CA	Monterey Bay Aquarium Research Institute	0	69,055	56,071
CA	McDonnell Douglas Corporation	29,623	60,341	49,576
CA	Dr. Herman Medwin	99,923	139,953	57,733
CA	Professor Walter Munk	0	250	0
CA	Nielsen Engineering & Research Company	50,336	52,055	15,041
CA	Occidental College	62,000	0	50,000
CA	Ocean Research & Engineering	394,250	903,250	684,483
CA	Orincon Corporation	247,197	387,158	239,027
CA	Pacific Sierra Research Corporation	139,308	106,883	96,213
CA	Physical Research Inc.	44,192	188,584	34,246
CA	Rockwell International Corporation	84,469	84,929	94,755
CA	Rockwell International Corporation	1,482,402	1,074,320	1,071,867
CA	Rockwell International Corporation	49,974	60,088	7,666
CA	Science Applications International Corporation	0	257,077	0
CA	Science Applications International Corp.	71,863	249,987	316,025
CA	Science Applications International Corp.	55,000	176,405	50,000
CA	Science Applications International Corp.	0	20,000	0
CA	The Salk Institute	0	0	150,000
CA	Saxpy Computer Corporation	92,348	0	0
CA	University of Southern California	1,901,364	2,575,379	2,926,668
CA	San Diego State University	105,636	144,480	6,565

CA	San Jose State University Foundation	187,918	285,642	650,099
CA	SRI International	641,357	744,247	1,107,599
CA	Scripps Clinic	195,500	0	89,707
CA	San Diego State University Foundation	0	0	90,925
CA	Leland Stanford Junior University	7,066,397	6,287,991	6,667,889
CA	Thomson-CSF, Inc.	0	0	150,000
CA	Thermo Electron Technologies Corporation	0	55,000	0
CA	Richard F. Thompson	250	0	0
CA	TRACOR Incorporated	0	36,356	50,000
CA	TRW, Incorporated	232,975	84,508	0
CA	Tetra Tech, Incorporated	0	153,221	0
CA	Lawrence Berkeley Laboratory	0	50,000	35,000
CA	Ultrasystems, Incorporated	0	10,000	0
CA	Vista Research, Incorporated	100,000	26,000	0
CA	Western Research Corporation	0	25,000	0
CA	Wyatt Technology Corporation	20,000	30,518	0
CA	Xerox Corporation	236,900	210,146	178,044
CA	Zak, Michail	0	250	0
CA	Dr. Peter Derven	0	250	0
CA	K. Mani Chandy	0	0	250
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	Total for CA :	46,296,954	42,897,068	46,910,702

State: Colorado

CO	Richard A. Anthes	250	0	0
CO	University of Colorado	1,457,483	1,457,043	1,145,292
CO	University of Colorado	312,558	255,279	321,984
CO	Colorado State University	811,295	1,236,686	784,297
CO	Colorado School of Mines	277,490	426,716	321,015
CO	The Keystone Center	0	0	8,000
CO	Eric B. Kraus	42,750	58,500	19,205
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	Total for CO :	2,901,826	3,434,224	2,599,793

State: Connecticut

CT	University of Connecticut	40,000	55,718	87,879
CT	University of Connecticut	669,783	926,525	545,857
CT	The Perkin-Elmer Corporation	105,849	0	0
CT	Scientific Research Associates, Inc.	300,213	178,217	362,913
CT	United Technologies Research Corporation	331,464	348,997	185,134
CT	Wesleyan University	48,280	0	0
CT	Yale University	1,047,327	1,043,722	1,290,967
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	Total for CT :	2,542,916	2,553,179	2,472,750

State: District of Columbia

DC	American Geophysical Union	0	0	10,000
DC	American Institute of Biological Sciences	45,000	90,000	31,000
DC	American Society for Engineering Education	2,268,041	2,649,491	5,445,372
DC	American Psychological Association	20,000	0	0
DC	The American Red Cross	0	0	82,002
DC	Associated Universities, Inc.	0	0	50,000
DC	Association of Universities for Research in	50,000	50,000	0
DC	Catholic University of America	265,875	510,441	610,190
DC	University of the District of Columbia	181,207	126,606	144,110
DC	Georgetown University	27,293	16,964	33,650
DC	George Washington University	438,062	1,016,192	938,064
DC	Howard University	57,997	115,955	122,430
DC	Mathematical Association of America	15,210	25,365	0
DC	Marine Technology Society	25,000	0	0
DC	The Oceanography Society	0	0	19,608
DC	Sperry Univac Federal System	3,986	0	0
DC	Universities Space Research Association	0	20,445	0
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	Total for DC :	3,397,671	4,621,459	7,486,426

State: Delaware

DE	University of Delaware	721,337	237,939	149,787
DE	University of Delaware	333,703	394,952	398,399
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	Total for DE :	1,055,040	632,891	548,186

State: Florida

FL	University of Central Florida	0	45,000	0
FL	Florida A & M University	121,236	50,000	199,876
FL	Florida Atlantic University	125,922	180,000	208,055
FL	University of Florida	639,424	729,843	550,483
FL	Florida State University	1,303,449	968,728	977,920
FL	Harbor Branch Oceanographic Institution Inc.	0	0	0
FL	University of Florida	69,590	0	0
FL	University of Miami	2,907,000	3,593,114	3,420,777
FL	Nova University	159,064	144,859	71,616
FL	University of South Florida	104,625	334,535	179,325
FL	University of South Florida	3,560	0	0
FL	Dr. James O'Brien	0	0	250
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	Total for FL :	5,433,870	6,046,079	5,608,302

State: Georgia

GA	Atlanta University	298,904	369,567	329,624
GA	Atlanta University Center	75,000	0	0
GA	Michael F. Barnsley	0	0	250
GA	Clark Atlanta University	0	0	561,462
GA	Emory University	172,405	306,900	875,836
GA	University of Georgia Research Foundation, Inc.	443,363	171,626	50,000
GA	Georgia State University	87,071	0	78,156
GA	Georgia Tech Research Corporation	1,638,651	1,788,559	1,553,955
GA	Skidaway Institute of Oceanography	89,625	254,082	368,425
	Total for GA :	2,805,019	2,890,734	3,817,708

State: Hawaii

HI	University of Hawaii	953,901	1,649,482	1,909,577
	Total for HI :	953,901	1,649,482	1,909,577

State: Iowa

IA	American College Testing Program	150,675	0	60,000
IA	University of Iowa	955,879	1,131,152	881,218
IA	Iowa State University	227,261	200,490	285,877
	Total for IA :	1,333,815	1,331,642	1,227,095

State: Idaho

ID	Boise State University	0	0	40,000
ID	University of Idaho	0	37,917	51,833
	Total for ID :	0	37,917	91,833

State: Illinois

IL	Allied Signal Research & Technology	0	0	100,000
IL	The University of Chicago	876,240	1,223,995	1,352,287
IL	Dr. Hans Frauenfelder	250	0	0
IL	T. Theodore Fujita	83,077	60,000	60,000
IL	Illinois Institute Technology	99,889	0	71,180
IL	University of Illinois at Chicago	1,069,350	940,345	805,941
IL	University of Illinois	3,963,899	5,248,977	4,346,203
IL	Loyola University of Chicago	0	59,607	48,408

IL	Loyola University	0	65,913	0
IL	Northern Illinois University	0	107,398	98,945
IL	National Opinion Research Center	119,512	98,390	102,511
IL	Northwestern University Medical School	0	0	95,000
IL	Northwestern University	1,303,680	1,690,862	1,657,683
IL	Southern Illinois University at Carbondale	229,546	287,342	303,811
IL	University of Health Sci. Chicago Med. Sch.	120,776	26,717	100,000
	Total for IL :	7,866,219	9,809,546	9,141,969

State: Indiana

IN	Indiana University Foundation	110,000	0	0
IN	Indiana University Foundation	0	81,321	83,231
IN	Indiana State University	0	26,406	21,933
IN	Indiana University	503,751	149,203	205,240
IN	University of Notre Dame	294,439	592,118	564,879
IN	Purdue University	0	0	54,389
IN	Purdue Research Foundation	1,508,729	1,730,631	1,254,476
	Total for IN :	2,416,919	2,579,679	2,184,148

State: Kansas

KS	University of Kansas	0	62,234	64,346
KS	University of Kansas	144,764	155,834	277,567
KS	Kansas State University	260,649	181,679	187,076
	Total for KS :	405,413	399,747	528,989

State: Kentucky

KY	University of Kentucky Research Foundation	136,178	154,408	160,358
KY	University of Louisville	12,809	16,761	56,581
	Total for KY :	148,987	171,169	216,939

State: Lousiana

LA	Grambling State University	0	0	191,007
LA	Louisiana State University	510,739	367,107	267,198
LA	University of New Orleans	313,130	462,682	666,772
LA	Tulane University	157,500	128,455	44,794
LA	Tulane University	0	0	60,000
LA	Xavier University of Louisiana	98,722	0	273,000
	Total for LA :	1,080,091	958,244	1,502,771

State: Massachusetts

MA	Alphatech Inc.	400,000	307,459	0
MA	Amherst College	119,000	0	0
MA	Aerodyne Research, Inc.	0	32,870	84,635
MA	BBN Laboratories Incorporated	177,906	113,228	249,367
MA	The Trustees of Boston University	572,938	590,565	382,044
MA	Boston College	0	46,961	26,000
MA	Chase, Inc.	0	36,000	94,000
MA	Clarke University	162,477	0	108,786
MA	EG&G Mason Research Institute	0	108,125	101,000
MA	EIC Laboratories, Inc.	249,578	121,229	121,229
MA	Harvard College	2,866,244	2,771,250	2,829,887
MA	Harvard University	0	148,850	112,000
MA	University of Lowell Research Foundation	302,404	317,063	280,255
MA	Marine Acoustics, Inc.	0	24,512	0
MA	University of Massachusetts	1,486,198	1,493,786	1,610,825
MA	University of Massachusetts	0	0	3,733
MA	Massachusetts General Hospital	30,989	119,891	60,582
MA	Massachusetts Institute of Technology	8,782,106	7,247,365	8,703,177
MA	Marine Biological Laboratory	15,000	59,540	99,540
MA	New England Medical Center Hospitals, Inc.	93,308	99,408	0
MA	Northeastern University	261,572	367,352	284,797
MA	OMNET	18,000	18,000	59,388
MA	Radiation Science, Inc.	0	0	59,682
MA	Raytheon Company	80,000	171,000	160,011
MA	Radcliff College	142,009	161,917	173,989
MA	Dr. Frederick Sanders	30,675	30,994	0
MA	Sippican Corporation	249,274	218,459	20,508
MA	Sonoquest	49,873	52,896	52,015
MA	Tufts University	229,921	283,675	68,967
MA	Woods Hole Oceanographic Institution	10,205,769	13,510,518	14,337,323
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	Total for MA :	26,525,241	28,452,913	30,083,740

State: Maryland

MD	The American Association of Physics Teachers	10,000	10,000	10,000
MD	American Red Cross	52,486	73,595	0
MD	Chemical Dynamics Corporation	0	0	55,000
MD	Dynaflow, Inc.	0	0	50,000
MD	Found. for the Advance. of Educ. in the Sciences	118,613	57,304	0
MD	Foundation for Biomedical Research & Education	0	0	118,889
MD	Federation of American Society for Exper. Biology	86,926	90,000	63,277
MD	ITE INCORPORATED	0	25,000	0
MD	Johns Hopkins University	3,133,785	2,958,051	2,607,159
MD	The Johns Hopkins University School of Medicine	0	0	40,000
MD	LNK Corporation	149,006	0	24,996

MD	Loyola College	27,813	58,633	64,066
MD	Martin Marietta Corporation	332,929	260,830	215,280
MD	University of Maryland	105,129	175,349	341,578
MD	University of Maryland	1,775,191	2,020,460	1,452,874
MD	University of Maryland	83,308	117,954	90,192
MD	University of Maryland at Baltimore	0	0	39,902
MD	Techno-Sciences, Inc.	0	0	117,727
MD	Meteorology and Supporting Research	0	0	10,000
MD	Uniformed Services Univ of the Health Sciences	28,854	172,248	162,588
MD	Westinghouse Electric Corporation	0	0	162,155
MD	W. R. Grace & Company	370,259	0	0
	Total for MD :	6,274,299	6,019,424	5,625,683

State: Maine

ME	Bigelow Laboratory for Ocean Sciences	459,849	513,970	482,458
ME	University of Maine	187,485	0	129,743
	Total for ME :	647,334	513,970	612,201

State: Michigan

MI	Calvin College	0	22,671	23,800
MI	Chia Shun Yih	25,000	30,000	50,480
MI	Environmental Research Institute of Michigan	193,078	727,818	808,313
MI	Henry Ford Hospital	0	0	110,194
MI	Regents of the University of Michigan	1,256,527	1,287,339	1,331,517
MI	Michigan State University	254,564	471,933	221,700
MI	Michigan Technological University	380,856	181,632	193,113
MI	Oakland University	84,375	0	28,125
MI	Ovonic Synthetic Materials Company, Inc.	65,000	66,311	162,180
MI	Western Michigan University	49,537	39,070	95,759
MI	Wayne State University	305,416	291,064	315,396
	Total for MI :	2,614,353	3,117,838	3,340,577

State: Minnesota

MN	Honeywell Incorporated	40,104	50,541	71,266
MN	University of Minnesota	65,209	80,798	156,838
MN	University of Minnesota	590,314	872,826	240,184
MN	University of Minnesota	73,749	211,602	324,275
MN	University of Minnesota	86,572	0	233,756
MN	Minnesota Mining and Manufacturing Company	75,000	64,521	0
	Total for MN :	930,948	1,280,288	1,026,319

State: Missouri

MO	McDonnell Douglas Corporation	160,000	79,905	0
MO	University of Missouri	60,000	59,886	49,767
MO	Curators of the University of Missouri-Kansas City	55,214	57,707	72,042
MO	The Curators of the University of Missouri	36,430	145,191	85,000
MO	University of Missouri	73,000	85,000	89,999
MO	Washington University	175,462	489,395	389,920
	Total for MO :	560,106	917,084	686,728

State: Mississippi

MS	Institute for Naval Oceanography	0	0	7,500
MS	Jackson State University	20,000	169,528	80,610
MS	University of Mississippi	172,825	0	76,460
MS	University of Mississippi	172,590	169,783	99,845
MS	The University of Southern Mississippi	115,000	92,952	299,473
MS	University of Southern Mississippi	0	58,425	0
	Total for MS :	480,415	490,688	563,888

State: Montana

MT	Montana State University	189,315	148,474	224,865
	Total for MT :	189,315	148,474	224,865

State: North Carolina

NC	Davidson College	0	29,995	0
NC	Duke University	176,225	279,425	418,716
NC	Duke University	821,033	555,706	283,653
NC	Duke University Medical Center	0	84,573	89,647
NC	Harry L. Hurd, Associates, Inc.	29,808	100,674	34,168
NC	North Carolina Agricultural & Technology State Un.	49,956	0	0
NC	The University of North Carolina at Greensboro	0	44,978	20,635
NC	North Carolina State University	1,092,090	1,323,463	1,474,692
NC	University of North Carolina at Chapel Hill	1,054,546	450,717	939,784
NC	University of North Carolina	62,433	42,443	19,990
NC	University of North Carolina	261,000	0	0
NC	Research Triangle Institute	0	0	2,449
	Total for NC :	3,547,091	2,911,974	3,283,734

State: Nebraska

NE	University of Nebraska Lincoln	209,302	120,370	115,745
NE	Science Applications Incorporated	163,000	0	0
	Total for NE :	372,302	120,370	115,745

State: New Hampshire

NH	Dartmouth College	65,964	92,720	199,341
NH	University of New Hampshire	251,482	20,000	169,851
	Total for NH :	317,446	112,720	369,192

State: New Jersey

NJ	Allied Corporation	160,000	154,957	0
NJ	Aeronautical Research Associates of Princeton, Inc	200,000	96,400	0
NJ	Bell Communication Research	0	0	101,000
NJ	Cambridge Hydrodynamics Incorporated	99,712	174,795	175,915
NJ	Dynalysis of Princeton	40,000	37,669	0
NJ	Educational Testing Service	60,000	78,602	100,272
NJ	Hoffmann-LaRoche, Inc.	0	0	120,000
NJ	Institute for Advanced Study	85,000	0	0
NJ	Litton Systems	55,408	106,556	0
NJ	New Jersey Institute of Technology	0	55,177	109,240
NJ	Princeton University	1,919,685	1,579,623	1,828,170
NJ	Rutgers University	245,310	101,719	0
NJ	Rutgers University	468,573	322,382	509,655
NJ	Stevens Institute of Technology	260,166	187,593	116,370
	Total for NJ :	3,593,854	2,895,473	3,060,622

State: New Mexico

NM	Ecodynamics Research Associates, Inc.	58,600	0	0
NM	New Mexico Institute Mining & Technology	251,071	0	233,000
NM	New Mexico State University	105,000	26,284	40,000
NM	The University of New Mexico Medical Center	0	0	45,000
NM	University of New Mexico	624,419	359,999	375,000
	Total for NM :	1,039,090	386,283	693,000

State: New York

NY	Albert Einstein College of Medicine	0	62,000	175,838
NY	American Institute of Physics	0	6,500	0
NY	The American Physical Society	0	23,010	0
NY	Columbia Univ. in the City of New York	1,606,709	818,798	1,741,970
NY	Corning Glass Works	0	0	100,000
NY	Clarkson University	294,073	81,149	20,000
NY	Columbia University in the City of New York	3,519,434	3,481,842	2,247,126
NY	Calspan Corporation	30,000	188,598	113,758
NY	Cornell University	2,622,598	3,045,736	2,603,064
NY	Cornell University Medical College	447,274	531,797	430,274
NY	Cold Springs Harbor Laboratory	0	20,000	20,700
NY	City Univ. of New York Brooklyn College	32,500	163,051	0
NY	Research Fdt. of the City Univ. of New York	242,383	256,738	388,569
NY	General Electric Company	115,350	0	247,077
NY	New York on Behalf of Hunter College	0	60,000	0
NY	International Business Machine Corporation	653,530	913,955	969,785
NY	Institute of Electrical/Electronic Engineers	5,000	0	0
NY	Long Island University	25,760	27,354	0
NY	Mayo foundation	25,000	75,000	50,000
NY	Dr. David Middleton	24,000	0	0
NY	Neurosciences Research Foundation, Inc.	0	200,000	307,000
NY	State University of New York at Stony Brook	1,178,741	2,085,563	1,629,578
NY	State University of New York at Buffalo	0	0	204,347
NY	Hofstra University	0	0	29,778
NY	New York Blood Center, Incorporated	18,750	56,250	75,000
NY	City University of New York	0	48,495	32,312
NY	Polytechnic University	848,163	650,177	596,228
NY	State University of New York	187,041	0	0
NY	New York University	1,699,183	1,220,791	1,154,160
NY	New York University	0	0	95,000
NY	New York Zoological Society	92,680	0	0
NY	The Public Health Research Institute	147,000	0	179,000
NY	Rondout Associates, Incorporated	29,688	285,000	198,149
NY	Research Foundation for Mental Hygiene, Inc.	(9,416)	0	0
NY	Rochester Institute of Technology	50,000	0	32,918
NY	University of Rochester	894,541	1,478,767	700,305
NY	Rensselaer Polytechnic Institute	1,300,076	1,243,697	1,034,677
NY	Roswell Park Memorial Institute	49,773	98,181	158,551
NY	Society For Industrial Microbiology	2,500	0	0
NY	Sloan Kettering Institute	29,781	0	0
NY	Syracuse University	159,921	216,754	182,878
NY	Xerox Webster Research Center	0	57,237	54,980
	Total for NY :	16,322,033	17,396,440	15,773,022

State: Ohio

OH	University of Akron	43,333	62,000	63,080
OH	Battelle Memorial Institute	308,850	206,362	269,242
OH	Battelle Columbus Laboratories	119,242	61,422	0
OH	Bowling Green State University	0	50,000	50,000
OH	University of Cincinnati	236,356	94,570	176,889
OH	Case Western Reserve University	1,196,147	1,011,482	992,952
OH	University of Dayton	0	0	40,000
OH	Gould, Incorporated	58,294	89,744	0
OH	Kent State University	0	0	0
OH	Northeastern Ohio University	32,453	79,893	47,808
OH	Ohio State University Research Foundation	441,304	622,172	914,138
OH	Ohio State University	421,066	655,529	465,271
OH	Wright State University	0	143,653	96,283
	Total for OH :	2,857,045	3,076,827	3,115,663

State: Oklahoma

OK	Oklahoma State University	167,132	141,468	197,000
OK	University of Oklahoma	43,190	171,240	0
	Total for OK :	210,322	312,708	197,000

State: Oregon

OR	Medical Research Foundation of Oregon	74,951	207,730	36,891
OR	Oregon Graduate Center	57,522	182,554	124,817
OR	Oregon State University	2,265,813	3,583,790	3,599,593
OR	University of Oregon	425,163	491,047	728,852
OR	Portland State University	52,709	61,711	50,000
OR	Sea Tech, Inc.	0	47,126	0
	Total for OR :	2,876,158	4,573,958	4,540,153

State: Pennsylvania

PA	Carnegie-Mellon University	2,391,991	2,312,166	2,197,232
PA	Drexel Institute Technology	30,000	50,000	40,000
PA	Drexel University	399,621	832,826	748,530
PA	Duquesne University	0	50,000	0
PA	Hahnemann University	0	0	64,317
PA	Hahnemann Medical College & Hospital	80,000	160,000	165,359
PA	Institute for Scientific Information	21,581	0	0
PA	InfoSoft Design Associates	39,211	57,000	30,095

PA	Information Ventures, Incorporation	89,859	94,934	33,434
PA	Lehigh University	1,105,071	999,713	1,042,178
PA	Lincoln University	194,566	100,000	375,000
PA	Medical College of Pennsylvania	129,516	0	113,292
PA	Mellon-Pitt-Carnegie Corporation	0	100,000	0
PA	Materials Sciences Corporation	0	0	79,677
PA	Pennsylvania Hospital Contributors	24,061	72,375	0
PA	University of Pennsylvania	1,696,288	1,116,406	1,742,912
PA	University of Pittsburgh	1,914,363	1,371,291	1,319,116
PA	Pennsylvania State University	1,481,975	855,153	1,343,436
PA	The Pennsylvania State University	2,768,421	2,806,610	3,252,612
PA	Temple University	37,255	44,706	0
PA	Westinghouse Electric Corp. R&D Center	29,774	0	0
	Total for PA :	12,433,553	11,023,180	12,547,190

State: Puerto Rico

PR	University of Puerto Rico	0	50,000	130,000
PR	University of Puerto Rico	134,869	134,869	184,869
	Total for PR :	134,869	184,869	314,869

State: Rhode Island

RI	Brown University	2,006,512	1,712,003	1,892,130
RI	Gordon Research Conference	12,000	3,000	4,000
RI	National Marine Educators' Association	5,000	0	0
RI	University of Rhode Island	704,261	655,549	159,421
RI	University of Rhode Island	1,784,131	318,297	1,644,691
RI	University of Rhode Island	0	1,569,303	375,299
	Total for RI :	4,511,904	4,258,152	4,075,541

State: South Carolina

SC	Clemson University	58,096	51,694	84,187
SC	University of South Carolina	151,155	115,592	82,668
	Total for SC :	209,251	167,286	166,855

State: Tennessee

TN	Meharry Medical College	78,101	0	71,304
TN	Memphis State University	0	198,250	163,705
TN	University of Tennessee	174,365	0	80,000
TN	The University of Tennessee	797,451	1,512,473	965,805
TN	University of Tennessee	0	0	110,904
TN	Vanderbilt University	80,088	71,437	33,203
		-----------	-----------	-----------
	Total for TN :	1,130,005	1,782,160	1,424,921

State: Texas

TX	Baylor College of Medicine	124,995	31,250	226,790
TX	Computational Logic, Inc.	0	100,000	104,000
TX	Ementech, Inc.	49,940	0	0
TX	Electrospace Systems, Inc.	10,000	33,406	33,966
TX	University of Houston	524,546	351,636	567,663
TX	National Association of Corrosion Engineers	0	20,000	20,000
TX	Pennzoil Products Company	0	70,000	82,700
TX	Rice University	449,487	643,502	670,495
TX	University of Southern Methodist	65,166	30,000	0
TX	Southwest Research Institute	261,928	238,493	228,572
TX	The University of Texas at Austin	268,864	321,362	708,238
TX	Texas Engineering Experiment Station	0	0	27,382
TX	Teledyne Geotech	75,183	119,097	67,041
TX	The University of Texas at Austin	1,416,569	1,805,098	2,095,564
TX	University of Texas	120,000	78,230	245,000
TX	The University of Texas Medical Branch	313,647	587,274	490,230
TX	University of Texas at Arlington	205,000	136,000	17,000
TX	Tracor Incorporated	100,000	0	0
TX	Texas Christian University	0	100,000	105,000
TX	Texas Instruments, Inc.	178,266	110,000	116,234
TX	Texas A&M Research Foundation	2,059,836	1,843,374	1,589,559
TX	University of North Texas	250,000	250,000	0
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	Total for TX :	6,473,427	6,868,722	7,395,434

State: Utah

UT	Brigham Young University	50,380	98,607	102,741
UT	Thiokol Corporation	0	0	64,552
UT	University of Utah	1,359,226	1,075,096	932,561
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	Total for UT :	1,409,606	1,173,703	1,099,854

State: Virginia

VA	American Institute of Biological Sciences	43,887	48,548	0
VA	Analytic Sciences Corporation	80,827	0	0
VA	Arete Associates Incorporated	0	0	19,109
VA	Barron Associates, Inc.	0	0	95,000
VA	The BDM Corporation	435,137	0	179,375
VA	Decision Science Applications Incorporated	63,326	0	0
VA	Decision Science Consortium Incorporated	15,000	14,072	0
VA	Engineering Research Associates, Inc.	48,525	0	0
VA	Engineering Research Associates, Incorporated	224,985	191,198	0
VA	George Mason University	246,620	468,355	600,199
VA	Hampton University	51,293	72,000	643,192
VA	IBM Corporation	0	35,000	161,407
VA	International Sociotechnical Systems	0	24,953	0
VA	MERRIFIELD RESEARCH LABORATORIES INC.	0	79,045	97,224
VA	Old Dominion Univ. Research Foundation	0	50,000	100,000
VA	Old Dominion University	0	50,000	0
VA	R. S. Million	0	1,884	0
VA	Science Applications International Corp.	414,900	325,000	21,575
VA	Science and Technology Corporation	37,000	81,500	39,513
VA	Unisys Corporation	0	2,407	2,148
VA	Virginia Commonwealth University	107,564	87,500	124,448
VA	Virginia Polytechnic Institute & St. Univ.	1,490,671	851,913	1,174,302
VA	University of Virginia	909,955	629,644	771,830
VA	College of William and Mary	33,673	36,240	91,061
	Total for VA :	4,203,363	3,049,259	4,120,383

State: Vermont

VT	University of Vermont	30,000	44,658	75,000
	Total for VT :	30,000	44,658	75,000

State: Washington

WA	Analytical Methods, Inc.	79,943	81,054	0
WA	Boeing Aerospace Company	80,000	0	238,954
WA	The BDM Corporation	0	531,177	0
WA	Coastal Climate Company	0	0	7,086
WA	Flow Research Incorporated	263,445	44,424	120,269
WA	Glosten Associates Incorporated	25,000	25,000	25,000
WA	Ice Casting, Inc.	0	38,779	84,487
WA	McPhee Research Company	55,651	149,146	180,995
WA	Northwest Research Associates, Inc.	0	0	85,000
WA	Pacific Marine Environmental Laboratory	290,900	475,900	328,201

WA	Science Applications International Corp.	0	0	19,369
WA	Science Applications International Corporation	16,077	0	0
WA	University of Washington	3,323,293	5,444,603	5,625,623
WA	University of Washington	4,358,412	3,331,631	4,603,357
WA	Washington State University	392,206	821,231	947,772
	Total for WA :	8,884,927	10,942,945	12,266,113

State: Wisconsin

WI	University of Wisconsin	785,853	1,252,437	1,206,317
WI	University of Wisconsin	40,000	114,223	89,046
WI	University of Wisconsin	121,515	411,908	279,663
	Total for WI :	947,368	1,778,568	1,575,026

State: West Virginia

WV	West Virginia University	0	124,559	69,269
	Total for WV :	0	124,559	69,269

State: Wyoming

WY	University of Wyoming	283,762	436,972	608,149
	Total for WY :	283,762	436,972	608,149
	TOTAL U.S. OBLIGATIONS:	191,495,069	197,435,476	207,681,603
	TOTAL OBLIGATIONS (INCLUDING FOREIGN):	194,946,686	201,027,355	212,336,953

Question. Provide the statutory and regulatory authority for the URI and URI-RIP programs.

Answer. The statutory and regulatory authority for the URI-RIP programs is granted annually through the Department of Defense Authorization and Appropriations Acts, i.e., in FY 1990 PL 101-189 dated 29 November 1989 and PL 101-165 dated 21 November 1989.

NAVAL OCEANOGRAPHY

Question. Last year the Navy testified that the Naval Ocean Research and Development Activity (NORDA) located at the Stennis Space Center had endorsed and supported a proposal by the University of New Orleans to establish an interdisciplinary doctoral degree program in Engineering and Applied Science.

What is the status of this proposal? Provide details.

Answer. The Letter of Intent to establish the doctoral conferring program has been approved and forwarded by the Council of Academic Officers for the Louisiana State University Systems and the Executive Graduate Council; action by the Board of Supervisors is pending, with final action by the Board of Regents to follow. The Proposal to implement would sequentially follow the same approval chain. Given these actions, the earliest possible start of limited operations would be Fall 1990; in light of the 5 year history of this proposal, this is not considered likely.

Question. Provide for the record the Fiscal Year 1990 and 1991 (requested) funding by program element for the Institute of Naval Oceanography at the Stennis Space Center. Provide details on the plans for the fiscal year 1991 funding for the Institute.

Answer. INO has been incorporated as an integral part of the Navy corporate laboratory, Naval Oceanographic and Atmospheric Laboratory (NOARL). Funding for INO for FY 1990 is $2.2 million from PE 0601153N, $.8 million from PE 0602453N, and $.2 million from PE 0603207 amounting to $3.2 million in FY 1990 and a requested $3.65 million for FY 1991. INO program plans for FY91 are concentrated on basic research and exploratory activity focused on achievement of a North Atlantic regional ocean prediction system with necessary acoustic interfaces for coupling to propagation models; and for an exploratory development activity centered on implementation of a facility for the test and evaluation of ocean prediction systems, the Experimental Center for Mesoscale Ocean Prediction.

NAVAL BIODYNAMICS LAB

Question. Provide for the record details on funding and work scheduled (by each program element) for the Naval Biodynamics Lab in Fiscal Year 1991 and how this compares to the Fiscal Year 1990 funding level.

Answer. The following funding is programmed for the Naval Biodynamics Lab for Fiscal Year 1991 and comparison figures are demonstrated for Fiscal Year 1990:

[In thousands of dollars]

Program element/project and work effort	Fiscal year— 1991	Fiscal year— 1990
0603216N/M0097—Aircrew impact injury	3021	2797
0603706N/M0096—Biomedical effects of ship motion and effects of motion on performance during sustained ops	350	360

[CLERK'S NOTE.—End of questions submitted by Mr. Livingston.]

Mr. DICKS. Mr. AuCoin.

Mr. AUCOIN. I just want the Chair to know that I am keeping a stopwatch and watching the amount of time each Member, including the acting Chair, has been using today.

I am just curious about this. This is a personal question, I guess. Is Mrs. McBurnett here today, your principal deputy assistant?

Mr. CANN. She came just to hear the action.

Mr. AUCOIN. Why isn't Mrs. McBurnett sitting in the front row?

Mr. CANN. She has been in this job for a very few days and she has never had an opportunity to testify before the Congress. I thought it would be nice to let her have one free ride.

Mr. AUCOIN. We welcome her.

TRIDENT SUBMARINE

I know the Navy has a preference for 24 Trident submarines but as I look at what is probably going to happen with the constraints that will be imposed by START, I think we are going to find ourselves with more Tridents than we can use.

My question is, if we have to make a policy choice to spread our SLBMs into more baskets by having fewer missiles per ship, do you have studies indicating what the best way to go is?

Mr. CANN. I would like to ask Admiral Hekman to answer that question, if I may.

Admiral HEKMAN. In answer to your question, sir, we do have studies that show the cost of spreading the Trident program, or stopping the program. To stop, of course, causes tremendous overhead costs in other programs and dire effects on the industry.

I would like to provide that to you and all of the options in the study for the record.

[CLERK'S NOTE.—Classified insert removed.]

Mr. AUCOIN. I am not talking about slowing down the rate of production of the platforms. I am talking about restrictions in the SLBMs, the weapons that will be fired from those platforms, and if START limits that number so that we have to spread those SLBMs across more platforms with fewer missiles per ship, what do your studies indicate is the best way to do that? Or do you have studies that indicate that?

Admiral HEKMAN. I would have to pass that question to the strategic side of the Navy. I don't deal in that, sir.

Mr. AUCOIN. You are engaged in research, development, test and evaluation for the Navy. Isn't that a consequence that you would have to deal with?

Mr. **Cann**. Yes, but I think the issue you have brought up is a complex issue.

One issue is how many warheads do you have at sea and then how do you distribute them and what happens if you don't continue to distribute them at the current distribution rate. This is a subject for the JCS and OP-02, and there is nobody here today that is in a position to discuss that.

Mr. **AuCoin**. All right. If the decision were made to disable some of the tubes on the Trident, has any thought—that may be an option—has any thought been given by the Navy to what use should be made of the space? Should we use the tubes for electronic equipment, for food storage, just take them out—use the space for crew habitat, what?

Admiral **Hekman**. That space is not needed for anything else.

Mr. **AuCoin**. Don't you have the crews actually bunking around the tubes?

Admiral **Hekman**. There is a great deal of room on those submarines. They are not around the tubes; they are outside the tubes and the quarters are very adequate in the submarines.

Mr. **AuCoin**. Would the crews say that?

Admiral **Hekman**. Yes, sir.

Mr. **AuCoin**. So it would make sense, then, to seal off the tubes, fill them in?

Mr. **Cann**. That is certainly one solution.

Mr. **AuCoin**. I am going to pursue that, then, for those at a different pay grade.

Mr. **Dicks**. Your time has expired.

You know about what the impact will be if we went to an every-other-year appropriation in terms of acquisition. That has been suggested and that is something Congress is going to give a serious look this year, so if you would like to provide something for the record about what the implications are of a stretch-out of the program. The reason is, one, we don't have a decision on how many warheads are going to be ICBM or SLBM. We know we are there at the edge. When you have 192 warheads per submarine of any possible scenario, I know that the arms control talks you are talking about not counting three Tridents. That isn't formalized yet. We are going to need some answers here which we have not received.

Mr. **Cann**. I need to clarify one thing for Mr. AuCoin.

I have been thinking about the issue that you brought up. Clearly, if the Navy were required to reduce the number of warheads, they would reduce the number of RVs per missile and that would allow you to do some other things, which is to get more range.

Mr. **AuCoin**. Well, I would think that would cause some very, very robust verification problems.

Mr. **Dicks**. It would still count as eight, wouldn't it?

Mr. **Cann**. I am not sure.

Mr. **AuCoin**. Sealing off the tubes would be far more verifiable than what you are talking about.

NEW STRATEGIC SUBMARINE

Mr. DICKS. There is another option, a new submarine. Is there any work being done within the Navy looking at a new ballistic missile submarine, a smaller one? This has been talked about.

Mr. CANN. Not that I know of.

Mr. DICKS. Are we going to have DARPA do this too?

Admiral HEKMAN. We have done conceptual studies of what is the optimum size and number of warheads and ranges. Those have been done.

In the studies, the optimum mix is the Trident.

Mr. DICKS. Somehow I knew that would be the answer. The most cost effective.

Mr. CANN. I was involved in the earliest ULMS study which——

Mr. DICKS. That is the Underwater Launched Missile system. They couldn't pass the program so they changed it to Trident, and it went right through Congress.

Mr. CANN. You usually end up with the largest platform with the most devices on it as being the cheapest way to go, unfortunately.

Mr. DICKS. The issue in the future is if you are going to have a START II through IV, you could have a small submarine with a number of single warhead systems and you want to proliferate to have more aim points, not fewer. That is especially if you have a detection problem, if any of this advanced technology got into play.

I am not saying that is going to be very cost effective, but the world could change. We are trying to figure out how to cut your budget, but you ought to be thinking about the possibility of a follow-on submarine.

SSN-21

What is the inventory objective for the SSN-21 class?

Admiral REYNOLDS. Thirty.

Mr. AUCOIN. In what time frame?

Admiral HEKMAN. The anticipated building rate was to have at least a minimum of three per year.

Mr. DICKS. Zero and then six and zero and six I heard last night; is that true?

Admiral HEKMAN. That is a strategy to try to take advantage of large lot procurement in that we would be able to purchase larger lots of material at earlier-year prices. However, that is very, very dependent on the numbers procured and on what it does to suppliers in the off years. So the arguments——

Mr. DICKS. I worry about years in this climate when there is zero in the budget.

Admiral HEKMAN. Yes, sir.

Mr. DICKS. We are going to do 30 SSN-21s?

Admiral HEKMAN. The CNO should answer that question, but the figures that I have at this time indicate that is the objective.

Mr. DICKS. What number of SSN-688 and SSN-637 class submarines will remain in the force over the next 10 to 20 years?

Admiral HEKMAN. I am not prepared to answer that question.

Mr. CANN. We will have to take that for the record.

[CLERK'S NOTE.—Classified insert removed.]

Mr. DICKS. Our total attack submarine force levels will be still around 100 over the next 10 to 20 years?

Admiral REYNOLDS. No, sir. The projections, of course, depend on the budgetary climate. One hundred was the force structure we were reporting. As we take out some of the older ships, we are on a downward ramp towards 80.

Mr. DICKS. That means we are going to take out SSN-688s that are only 15 years old?

Admiral REYNOLDS. No, sir. The SSN-594 Permit class and the early SSN-637 Sturgeon class ships.

Mr. DICKS. So what we had heard was that there were reports that the Navy was considering classifying refueling of SSN-637 and SSN-688 class submarines as modernization and not proceeding with them, effectively retiring these submarines well before their available service life is used; is that correct?

Mr. CANN. I am not sure, there may be some.

Mr. DICKS. Out of how many?

Mr. CANN. Let me get the facts on that whole subject and supply it for the record.

[The information follows:]

There are currently no SSN 637 Class overhauls to start in the FY 1991 President's budget. One SSN 637 Class ship, the USS LIPSCOMB (SSN 685) is currently being deactivated, leaving an active force level of 38 SSN 637's.

VERTICAL LAUNCHED ASROC

Mr. DICKS. The Director of Operational Test and Evaluation in the Office of the Secretary of Defense recently submitted his annual report to the Congress. It indicates the results of testing on the vertical-launched ASROC system, which are not encouraging.

Please describe the results of the developmental and operational verticle-launched ASROC test firings conducted last year.

Mr. CANN. Of the seven missile firings, there were three that were completely successful.

Mr. DICKS. Okay. And four were——

Mr. CANN. Four were obviously not successful, but I don't know the details.

Mr. DICKS. I have additional questions for the record.

[CLERK'S NOTE.—Classified insert removed.]

Mr. DICKS. What are the limitations of the MK-46 torpedo which is a component of the vertical-launched ASROC system?

Mr. CANN. The MK-46 torpedo, which is our basic in-service weapon for everything except submarines, has a good capability. It has less acquisition range than the MK-50, but it is perfectly adequate to support a system like the VLA system because of the expanding area of uncertainty.

Mr. DICKS. The director of OT&E says that the MK-46 MOD 5 torpedo payload for the vertical-launched ASROC has significant acknowledged limitations against the modern threat.

Mr. CANN. There is a fundamental issue with the MK-46 in which it is not effective against ———. That is an acknowledged issue. That is one of the primary reasons we got into the Advanced Lightweight Torpedo, which is ———.

Mr. DICKS. How much is budgeted in fiscal year 1991 to begin integration of the MK-50 torpedo into VLA?

Mr. CANN. Thirty million dollars.

Mr. DICKS. What is the total development of the proposal?

Mr. CANN. One-hundred and seventy-five million dollars.

Mr. DICKS. Would this action be necessary if the Navy had not canceled Sea Lance?

Mr. CANN. Well, I guess one could argue that it probably would not have been necessary.

Mr. DICKS. A recent press article states that Pentagon acquisition chief John Betti has suspended a VLA operational test scheduled for March since previous test results were poor. Is this accurate?

Mr. CANN. No. The operational tests are still on schedule.

Mr. DICKS. When are the next tests of VLA planned and what are their objectives?

Mr. CANN. The OPEVAL is scheduled for the third and fourth quarters of fiscal year 1990.

DETECTION OF SOVIET SUBMARINES

Mr. DICKS. At what range or distance can we detect Soviet submarines? I know that is scenario-driven and there are a lot of variables.

Mr. CANN. It depends on whether you are doing it passively or actively.

Mr. DICKS. Let's say passively.

Mr. CANN. I am going to let Admiral Reynolds, who was a commander of SUBPAC answer.

Mr. DICKS. We have a real expert here.

Mr. CANN. I tend to get too technical, so I am going to let him answer the question.

Admiral REYNOLDS. There is a distribution of what that detection range is based on: which one of our submarines is looking, what the environmental conditions are, what the other platform is, and, of course, what he is doing.

Mr. DICKS. For the purpose of this question, say it is our best SSN-688 versus their best Akula.

Admiral REYNOLDS. ———.

Mr. DICKS. You mean a lot fewer miles?

Admiral REYNOLDS. Yes, sir.

Mr. DICKS. ———.

Admiral REYNOLDS. ———.

Mr. DICKS. ———?

Admiral REYNOLDS. I believe that is above the classification of this hearing, sir.

Mr. DICKS. Special Access?

Admiral REYNOLDS. Yes.

Mr. DICKS. Let's go into a Special Access session. We will clear the room for a short while.

[CLERK'S NOTE.—The Committee proceeded to a Special Access session.]

Mr. DICKS. Could you provide some clarification of AKULA missions and how its quieting impacts operations for both protecting SSBNs and an effort to disrupt resupplying Europe in a conventional war? In which is their quieting more significant?

Mr. CANN. ———.

IMPROVED SSN-688 SUBMARINE

Mr. **Murtha.** We want to continue to spend the money to make sure the Navy is always superior in submarine capabilities. We want to make sure we keep the necessary R&D.

Answer another question first about the improvement of the SSN-688.

Mr. **Cann.** The SSN-688 was a submarine that was brought into the system in the early 1970s and has been around for 20 years. We have made incremental improvements all the way through. We have run out of space and weight on that ship. We have improved the combat system——

Mr. **Murtha.** In other words, even if you miniaturize components, you don't see any way you can put anything else into that submarine?

Mr. **Cann.** Nothing substantial. You can't quiet any further and that is the major issue.

Mr. **Dicks.** SSN-21 is a much larger submarine?

Mr. **Cann.** Yes.

BSY-2 COMBAT SYSTEM

Mr. **Dicks.** We are saying we are building the SSN-21 submarine, yet there is no testing of the integrated computer sensors of the automated combat system. What bothers me about that is it is the same thing that happened before and we got into serious difficulty.

Mr. **Cann.** There is a basic difference between what happened last time and what happened this time. There were several differences. I was around for most of that, but I left at a very inappropriate time, it turned out.

At that time we had a program that was called the SUBACS, which was marching along in an orderly fashion. SSN-751 was put on order and accelerated because it was an opportunity to get it faster. Unfortunately, even though the combat system contractor at the time thought he could accelerate it, fell on his face; he got into serious problems with design and validation of some of the concepts, and in midstream we made a fundamental change to that combat system and separated out the follow-on part.

The difference is that the BSY-2 is for the SSN-21. It started off as the combat system for that ship and has been a rigorous program to get there in an orderly way. The architecture for the BSY-2 is different.

Mr. **Dicks.** But you haven't done the operational testing.

Mr. **Cann.** Yes. An interesting problem is, until you put it in as SSN-21, you won't have any place to test it.

Mr. **Murtha.** Wouldn't we be better off building one only this year?

Admiral **Hekman.** I don't think so. The combat system hardware configuration is fully designed for the BSY-2 and for the SSN-21. The BSY-2 will be delivered to the shipbuilding yard in late 1933 in time for the ship to go to sea in mid-1994. That configuration is already fully defined.

The software has met its critical design review as of January of this year, and is proceeding perfectly on schedule. The design coordination with the ship design and with the combat system design being done at Newport News, has been outstanding.

If you want to see a perfect example of the way to integrate a system, you should see that. I have no problems with it at all. I feel the risk is very low to have this system totally up and delivered long before the ship delivery date.

Mr. **MURTHA**. Can we put this on the shelf and wait four or five years and go back and pick it up?

Admiral **HEKMAN**. No, sir. As with any system, we will continue to improve it.

Mr. **MURTHA**. We have a capability of building them in four or five years at the stage you are at now?

Admiral **HEKMAN**. The ship?

Mr. **MURTHA**. Yes.

Admiral **HEKMAN**. If we could stop that program, we would also stop the industry in its tracks and I couldn't guarantee the industry would ever come back.

Mr. **MURTHA**. I keep asking the Secretary, what are you going to do next year, because I figure he is going to cut this thing out next year. So if he is going to do it next year, we might as well do it this year. He hasn't said that.

So what you are saying is that if you cut this program out, you lose the industrial base; it would take you years to gear that back up again to build a submarine, or are they doing something else where they could switch over in five years?

Admiral **HEKMAN**. They are not doing anything else.

Mr. **DICKS**. We are not building any more SSN-688s?

Admiral **HEKMAN**. We went to contract with the last SSN-688 this year. We still have 19 in the production line, and some of them are still going through the final work and the final PSA.

In the combat systems area for those ships, we have just fielded the full first-up total BSY-1 system, so we will end up with 23 of those ships fully equipped with the BSY-1 system.

I think it is important to remember that ships with the BSY-1 and the BSY-2 system can go from detection to firing a weapon ——— vice the old style of ——— to reach a solution.

Mr. **MURTHA**. Thank you very much, gentleman. We will have other questions for the record.

The committee adjourns until 1:30 p.m. this afternoon.

[CLERK'S NOTE.—Questions submitted by Mr. Miller and the answers thereto follow:]

MIRACL LASER

Question. Last year, the Navy tested the MIRACL laser against a high speed surface to air missile. What was the purpose of this test and what were the results?

Answer. In February 1989, the MIRACL/SLBD system acquired from a radar a Vandal missile (a modified Talos) in flight, tracked it and ———. The test served two purposes: First, it validated estimates of the capability of an HEL system to acquire, track, and ——— and second, it allowed ———.

Question. Does the Navy foresee MIRACL as having an application as a defense against cruise missiles?

Answer. Analyses have concluded that these types of directed energy weapons offer ——— for engaging high speed, low radar cross section, maneuvering sea skimmers. The Navy is now assessing costs and benefits of directed energy systems compared to advanced missiles and gun alternatives.

Question. Does the Navy have any plans to test this system at sea?

Answer. A variety of at sea test options have been examined, ranging from a DEM/VAL system placed aboard an unmanned target ship to an Advanced Development Model (ADM) System placed aboard a manned vessel. The least costly of these plans is estimated to require about ———. No funding currently exists for this step.

[CLERK'S NOTE.—End of questions submitted by Mr. Miller. Questions submitted for the record and the answers thereto follow:]

STRATEGY UNDERLYING WEAPONS DEVELOPMENT

Question. Recent events in Europe may have profound effects on U.S. military strategy.

What efforts are on-going to redefine and update the Navy's strategy?

Answer. The U.S. is a world leader, dependent on the seas as avenues of trade and links to allies. The Administration's efforts updating our national security strategy is evident in the President's report on the National Security Strategy (March 1990). In this report, the President indicated that the U.S. military will be smaller, more global in its orientation, responsive to changes in warning time and well suited to the demands of likely contingencies. The Navy and Marine Corps clearly support the national military strategy with ready and capable forces. Our forces provide needed deterrence and forward defense. A careful review of U.S. defense requirements does not support alerting the ready, forward, defense posture for the Navy and Marine Corps.

Question. How do these actions affect the requirements for and development of Navy weapon systems?

Answer. Soviet technological progress is clearly evident in ship and submarine construction as well as in strategic systems. The opening to the West has been partially motivated by the need for Western technology to support Soviet weapons development. Also, as the President noted in his report on the National Security Strategy (March 1990), in addition to the threat posed by the Soviet Union, Third World conflicts may, for a variety of reasons, continue to threaten U.S. interests. Expansion of armed forces of regional powers and the proliferation of advanced weapons make Third World battlefields in many ways as demanding as those we would expect defending Europe. As such, retaining maritime superiority and the ability to project U.S. power ashore will take modern weapons, with up-to-date capabilities in each warfare area.

REFORM OF THE NAVY ACQUISITION PROCESS

Question. Mr. Cann, the Navy recently established your position of Assistant Secretary of Research, Development, and Acquisition in the Pentagon, as well as substantially reorganized its acquisition management structure at lower levels.

Explain the roles of your newly established PEOs—Program Executive Officers. Why did it take the Navy so long to move to this structure, which the Army has had for 2 years?

Answer. Our former structure also provided for PEOs, but they were dual hatted as SYCOM Commanders. We believe this structure was consistent with the recommendations of the Packard Commission, in light of the abolition of the Naval Material Command in 1985. However, we will now establish the PEOs and Direct Reporting PMs separately from the SYSCOMs (and the Marine Corps Research, Development and Acquisition Command), as required by the Defense Management Report. We believe this new structure will provide a great benefit by providing full-time management attention on critical development phases of high dollar programs. Also, we believe that program stability can be further enhanced by increasing the visibility of major program funding and isolating funding control under the new structure.

Question. What functions will still be performed outside the PEO structure.

Answer. Our major SYSCOMs will still perform functions outside the PEO structure to support the acquisition process. However, these functions will be limited to three primary areas: managing acquisition programs not administered by the PEO structure; providing support services to the PEOs/PMs without duplicating any of their management functions; and providing necessary logistical support. The SYSCOMs will no longer exercise program direction authority or control the funding or personnel authorizations for programs assigned to PEOs and Direct Reporting PMs. Further, the SYSCOM Commander will no longer approve required acquisition documentation, program certifications or resource adjustments for programs managed by the PEOs and Direct Reporting PMs.

Question. How much time will an Assistant Secretary responsible for all Navy R&D and all Navy acquisition be able to devote to ADP?

Answer. I obviously will not be able to devote full time to ADP, but I will have a staff who can identify those issues in which I need to become personally involved. My role will be to move ADP into mainstream, to provide the impetus needed to resolve the difficult issues, and to assure that the right decisions are made.

Question. Explain Navy's plan to create a new space and electronic warfare command to be run by a three star admiral. How will this affect/improve management of Navy electronic warfare acquisition programs?

Answer. Last summer, a task force looked into the way the Navy addressed the entire area of Space and Electronic Combat (SEC). This panel defined SEC as surveillance, targeting, communications, counter-surveillance, counter-targeting and the command and control mechanisms necessary to coordinate all these functions. The panel recommended a more centralized management of these functions. Presently, OP-094 is the sponsor for all the SEC elements except the traditional electronic warfare systems. Navy is evaluating increasing the role of OP-094 in overseeing all EW issues and transferring battle group EW programs under their sponsorship.

There is currently no intent to transfer platform-specific EW systems away from their existing sponsors due to the integral requirements those systems satisfy in their respective weapon systems. Centralizing the management and increasing the oversight, though, will improve the overall process of defining and satisfying electronic combat requirements across all platforms and relative to other warfare disciplines.

Question. Many in Congress have been concerned about the decline in funding in the Defense Technology Base: programs involving basic research and science.

Congress tends to focus on weapon system programs, so we don't discuss the technology base very often. What recent achievements has the Navy had with the annual funding in the Technology Base area?

Answer. ———.

STANDARD SIGNAL PROCESSORS AND COMPUTERS

Question. The Committee has long been in favor of Navy plans to have families of standard signal processors and standard computers embedded in its weapon systems rather than one-of-a-kind standalone systems. Despite its leadership in this area, the Navy often allows its individual weapon system acquisition program managers to exempt their programs from this common sense requirement in the name of short-term savings. This is penny-wise and pound-foolish.

Discuss the capabilities of the Navy's standard signal processors and standard tactical computers. How well do they perform? How much did we spend to develop them?

Answer. The current Navy standard computers have performed very well since their introduction in the early 1980s and should continue to do so for years to come with the improvements that are underway. Navy currently has three general purpose standard computers which serve around 90 systems; the AN/UYK-43 which is a 2,200 pound mainframe for large shipboard applications; the AN/UYK-44 which is a 165 pound minicomputer for mid-range applications; and the 50 pound AN/AYK-14 which is the standard aircraft tactical computer. These computers are being upgraded to better meet emerging requirements. The AN/UYK-43 will be enhanced from its current 4.6 million instructions per second (MIPS), 20 megabyte memory capability to around 30 MIPS and 80 megabytes of memory. The AN-UYK-44 and AN/AYK-14 will both increase from their current 0.9 MIPS to about 7.0 MIPS with similar improvements. In then-year dollars, the development cost for the AN/UYK-43 was approximately $55 million because of the dual source development approach that was used. The development costs of the AN/UYK-44 and AN/AYK-14 were approximately $25 million and $104 million respectively.

Navy is transitioning from its earlier standard signal processor, the AN/UYS-1, to the AN/UYS-2, commonly known as Enhanced Modular Signal Processor (EMSP). The AN/UYS-1 was developed in the mid seventies at a cost of around $200 million and performs at 20 MIPS. As the follow-on, EMSP comes in two versions; the Standard Electronics Module (SEM) "B" and "E" formats. The

SEM B variant performs from 28 to 1,200 MIPS, the SEM E variant from 40 to 1,600 MIPS depending on the configuration of modular components. In then-year dollars, development costs for the two variants are approximately $220 million for SEM B and $120 million for SEM E.

ASW WARFARE

Question: ASW is said to be the Navy's top priority. Last year, the Navy established a consolidated ASW development office.

Describe the R&D technology base initiatives in your current budget in the ASW area. What are you trying to accomplish?

Answer. The goal of our ASW technology base program is to provide our forces with the capabilities to detect, localize, and, if necessary, kill present and projected threat submarines wherever encountered. To achieve this goal, the 6.2 program maintains a robust, continuing program of development in a wide spectrum of surveillance and weapon-related technologies, including those environmental technologies necessary to support effective system design and utilization.

This year, the Navy's 6.2 program, with the interest and support of the Congress, is pursuing new initiatives in nonacoustic ASW, full spectrum signal processing, and tactical oceanography. It is also accelerating the development of High Gain passive systems and continuing the development of revolutionary torpedoes under the Advanced Torpedo Technology Thrust which began in 1989.

Nonacoustic ASW. As projected threat submarines become quieter, systems developed under this program will become increasingly important to complement our acoustic methods of detecting and localizing threat submarines. This initiative contains tasks in ——— with the goal of developing effective and affordable suites of nonacoustic sensors for a variety of platforms. This program is coordinated with similar work conducted under the auspices of OSD and other agencies.

Full Spectrum Signal Processing. Advances in submarine quieting make it imperative that we fully utilize all available acoustic signals. This initiative focuses effort on ——— through use of advanced signal processing techniques.

Tactical Oceanography. In the past we have not always taken full advantage of the environment in the design and operation of our ASW systems. We can no longer afford this luxury. The Tactical Oceanography Initiative is concentrating, initially, on developing better methods of measuring ocean characteristics such as fronts and eddies, ——— and the ——— variability of ambient noise. The goal is to couple such measurements into improved forecasting and simulation models which can be used to foster a wide variety of ASW improvements including the design and operation of long and short range surveillance systems, improved submarine tactics, better forecasting for optimum battle-group routing, and development of tactical decision aids.

High Gain Systems. As the potential threat has become quieter, present ——— systems have become less effective. High Gain systems, consisting of ——— offer the potential to restore this capability and offer a cost-effective alternative to other means of obtaining the same end. They serve to complement other systems which would be more effective in shallow water or in choke points by providing long-range, ——— capabilities. This year's program builds on work started in the 6.2 core program by accelerating the pace of critical, measurement experiments and fostering earlier industry involvement in low-cost ——— construction and engineering.

Advanced Torpedo Technology Thrust. This program develops the ——— technologies necessary to provide high lethality underwater weapons to counter any projected threat submarine. It expands and accelerates work begun in the ASW weapon technology base program. The focus is on and beyond the next generation of torpedoes. The initial effort concentrates on developments leading to an in-water demonstration of the key technologies necessary to develop both a ———.

The Navy's Advanced Technology Transition Demonstration (ATTD) Program within the 6.3A account provides for transition of the most promising technological opportunities from the 6.2 account into 6.3B and 6.4 programs through risk-reducing Advanced Technology Demonstrations (ATD) which generally are three-year funded projects. This program is a primary Navy vehicle for implementation of recommendations of the Packard Commission and the 1987 Defense Science Board study. It provides a linkage between Navy requirements and emerging technologies through transition of the best maturing 6.2 concepts and by reducing system development risks.

In addition to ASW-related ATDs which were started in FY 1989 and FY 1990, four ATDs with ASW applications will be initiated in FY 1991.

High Performance, Low Cost ———. The objective of this ATD is to demonstrate in late FY 1993, on the Navy's R&D submarine, an array technology using ——— hydrophones, ——— multiplexing, demultiplexing and demodulation, and ——— hull penetrators, reducing the net weight of the wide aperture array ———.

SPOTLIGHT. This ATD will develop and demonstrate an advanced real time undersea warfare Theatre/Regional/Sector battle management workstation with automated image alertment, undersea warfare data fusion, and an interactive operator-machine-loop system. The final demonstration ——— will demonstrate the ability ——— to focus resources on a specific ocean area.

Quiet, High Speed, Surface Ship Propellers. The objective of this ATD is to demonstrate a reduction of surface ship acoustic signature by ——— and to increase propeller cavitation-free ship speed to ———. The final demonstration and testing of cavitation and noise trials with a DDG 52 is scheduled for the ———.

Air/Surface ASW Weapon, ———. The objective of this ATD is to demonstrate a ——— increase in ——— for an advanced lightweight torpedo propulsion system to permit an advanced warhead design to be implemented ——— with increased weapon speed and endurance. The final in-water demonstration is scheduled to occur ———.

While focusing on the major changes that will take place in technology base efforts in the next fiscal year, the Navy is also pursuing aggressive technology base development programs in other critical areas, such as ——— all of which are essential to provide the balanced, effective and affordable ASW warfighting capability we will require in the future.

SSN-21

Question. The fiscal year 1991 budget requests over $.5 billion for continued development of the SSN-21 submarine and automated combat systems for the improved SSN-688 (called BSY-1) and the SSN-21 (called BSY-2).

What is the status of the SSN-21 Development program?

Answer. The SSN-21 Development Program is on track and on schedule to support SEAWOLF lead shop delivery in FY 1995.

SEAWOLF is over eight years into a thirteen year process to deliver a ship that will maintain our undersea superiority well into the 21st century. The detailed SEAWOLF design has been ongoing for more than three years at Newport News Shipbuilding, which is the lead design yard. Electric Boat Division is the propulsion plant design yard and is also a major subcontractor to Newport News Shipbuilding for detailed design. Detailed design continues to be on schedule to support lead ship construction requrements.

A contract for construction of the lead ship was competitively awarded to Electric Boat Division in January 1989. Construction is proceeding at Electric Boat with no problems encountered to date. Advance procurement contract actions were initiated in FY 1988-1989 for the first follow ships in FY 1991.

Question. Is the development program on schedule?

Answer. The SSN-21 development program is on schedule.

Question. The General Accounting Office recently published a report on submarine combat system programs which has received much publicity. It states:

—"The Navy's submarine combat system development programs are experiencing problems."

—"AN/BSY-1 program problems raise questions as to when the improved SSN-688s will be fully mission capable."

—"It appears that potential problems in the AN/BSY-2 are similar to those experienced in developing prior submarine advanced combat systems . . . the first BSY-2 combat system will not have full capabilities when delivered to the SSN-21 shipbuilder."

Please discuss the GAO findings and the Navy's response to them. Is GAO all wet?

Answer. The software delivery delay problems experienced with the AN/BSY-1 program have been resolved. The USS San Juan (SSN-751) is now fully BSY-1 capable and has been operating with the full up combat system since December 1989. The first ship to be fully BSY-1 capable at delivery will be the USS *Miami* (SSN-755), scheduled to deliver on 26 May 1990. The ships which are not fully BSY-1 capable now (SSN 752-754) will obtain a full capability during their scheduled post shakedown availabilities.

The AN/BSY-2 combat system will be completed on time for the SSN-21 lead ship delivery. SSN-21 will commission in May 1995 with all BSY-2 software delivered. The last increment (thread six) will be delivered to the Navy in November 1994.

Question. The Director of Operational Testing and Evaluation's annual report to the Congress indicates that "none of the critical operational issues" concerning BSY-1 operational testing have been resolved. Please explain why this condition exists, and what Navy is dong to resolve this issue.

Answer. BSY-1 has been extensively tested at sea on three submarines, including the full production baseline configuration. All three successfully completed Weapon System Accuracy Trials (WSAT) with better results than previous combat systems. For SSN-751, all 20 deficiencies noted by INSURV were corrected by the production baseline version, resulting in INSURV's determination that a retrial was not required.

MINE/COUNTERMINE PROGRAMS

Question. Ever since the U.S.S. *Roberts* was struck by a mine in the Persian Gulf, we have been concerned about Navy mine and countermine programs.

We understand that a report on mine/countermine programs has been completed after a 5-month CNO-sponsored study. What were the major findings of the CNO Executive Board Task Force (CEB-TF) on Navy mine/countermine capabilities?

Answer. The major findings of the CNO Executive Board Task Force (CEB-TF) on Navy mine/countermine capabilities resulted in decisions to increase our mine countermeasure force goals. The CEB-TF found that, although planned equipment and platforms will have capabilities to combat the mine threat ———.

The CEB-TF recommended, and the CNO concurred with, a constrained increase in mine countermeasure force level goals. In developing program objectives for FY 1992, we consider additional forces beyond earlier force level objectives. Increased force level goals are:

——— MH-53H helicopters,
——— deployable dual-mission ships, and
——— coastal ships.

These programs will compete with other high priority issues, and their achievement will be paced in consonance with the Navy's overall requirements.

Question. Is Navy's current and projected mine countermeasures force assessed by this group to be adequate to meeting the threat, especially that posed by Third World nations?

Answer. The Navy's current goals stated above, determined as a result of the 5-month CNO-sponsored study and projected mine countermeasures force assessed by the CEB-TF are adequate to meet the full range of mine threat scenarios, including the Third World threat.

As a result of the recommendation of the MCM CEB, the CNO has concurred with an increase in mine countermeasure force level goals. Several research and development efforts and additional mine countermeasures forces; specifically an increase of ——— are required to meet the mine threat. Our program objectives for FY 1992 will consider these research and development efforts and additional force objectives.

Question. Describe the R&D funding in the fiscal year 1991 budget for mine/countermine development programs. In light of the recent findings of the study group, is this amount adequate?

Answer. The R&D funding in the FY 1991 budget for mine/countermine development programs is adequate. The FY 1991 funding by program element is provided as follows:

Program Element and R&D Program		*FY-91 Funding (thousands)*
0603260N	Airborne Mine Countermeasures	$16,930
0603502N	Surface Mine Countermeasures	21,003
0603601N	Mine Development (Advanced)	5,042
0604601N	Mine Development (Engineering)	12,444

Question. Describe what the Navy is doing to give its ships mine self-protection capability. Discuss acoustic silencing and magnetic signature reduction objectives.

Answer. The Navy is actively involved in improving its ships mine self-protection capabilities. In the area of *acoustic silencing,* the Naval Sea Systems Command has established radiated noise requirements for most Navy ship classes. These reductions in radiated noise will improve a ship's counterdetection ability by acoustic sea mines. Such noise reduction methods as the employment of air emission devices, called Prairie-Masker systems, are currently employed by some ship classes. Recent Navy designs, particularly those of mine warfare ships (MCM and MHC) have employed —— of machinery and, in the case of the MHC, —— machinery systems to reduce radiated noise.

In the area of *magnetic signature reduction,* the Navy has established preliminary magnetic performance goals for battle force combatants. The Navy is considering a Memorandum of Understanding with France to share technology on Closed Loop Degaussing commencing in FY 1991. Closed Loop Degaussing will —— to the appropriate type of magnetic mines.

NAVY ATF

Question. The Navy has a terrible track record for using aircraft designed by the Air Force. All Armed Services and Appropriations Committees are concerned that this not happen again with the Air Force's Advanced Tactical Fighter (ATF), where the design and development cost alone exceeds $13 billion.

Mr. Cann, what actions have you taken to ensure that the Navy ATF becomes a reality?

Answer. The Navy signed an MOU with the USAF in 1986 on Navy participating in the ATF program set up a Program Management Office collocated with the Air Force ATF SPO. We are part of the Air Force dem/val phase and are developing joint specifications with the Air Force as well as performing Navy unique efforts. The Navy will be part of the ATF source selection process. The NATF program is fully funded.

Question. Among all Navy acquisition programs, where does Navy ATF fall in your priority ranking?

Answer. The continued viability of the carrier battle group against future threats is a top priority in the Navy. An integral portion is a fighter capable of meeting Navy requirements. The Navy is firmly committed to the joint participation with the Air Force and sees this joint program as the most affordable option for a new fighter that would satisfy Navy requirements. The exact timing of the Navy entering FSED is currently under review balancing requirements versus affordability.

Question. We understand that the Navy version may not be identical to the Air Force version, but the key is to have a high degree of commonality. What is your goal for commonality between the ATF designs for the two services?

Answer. Due to carrier suitability requirements and unique operational requirements, the Navy and Air Force airframe designs will be different, but the overall aircraft will still exhibit a high measure of commonality including engines, avionics, subsystems, materials, software, etc. Current estimates on the savings to the Navy in FSED are roughly $5 billion over a Navy stand alone development. We do not have a goal for commonality in parts counts. Our goal is maximum cost savings.

Question. To achieve a high degree of commonality, joint avionics programs are mandatory. Our committee requires in law that the designs of the Army LHX, all variants of the Navy Advanced Tactical Aircraft (ATA), and all variants of the Air Force Advanced Tactical Fighter (ATF) must incorporate joint standard avionics specifications by 1998. What actions have you taken to ensure that the intent of this legislation is fully met?

Answer. We fully support and are actively involved in the activities of the Joint Integrated Avionics Working Group (JIAWG). We are ensuring that all specifications include Navy unique requirements.

Question. The Air Force recently announced a six month slip in the ATF demonstration/validation phase. One rationale is to provide the Navy more time before the Air Force makes the critical contractor "down-selection" next year. How comfortable are you personally with the pace of the Air Force's ATF program and the degree to which Navy requirements will be met?

Answer. The Navy did not request the six-month stretch of dev/val, but the time will be well used by the two teams to provide additional wind tunnel data for their carrier suitability tests. The Navy is comfortable with the pace of the program leading to a down select next year. At that time the Navy expects to be able to assess the two teams NATF designs for carrier suitability and mission effectiveness. After down select, the Navy will continue in an extended dem/val phase to further refine the winning team's NATF design.

P-7 (LRAACA)

Question. A recent press article quotes the Navy's program manager for the P-7 LRAACA (Long Range ASW Aircraft/P-3 Replacement) as saying that the program is overweight and two years behind schedule, with the delay likely to lead to cost increases yet to be determined.

Mr. Cann, what is wrong with the P-7 program?

Answer. On 15 November 1989, Lockheed Aeronautical Systems Company (LASC), the prime aircraft developer, in a public declaration and discussions with NAVAIR, notified the Navy of design, schedule and cost problems in the P-7A development program. Lockheed's initial estimate is that development costs will exceed the ceiling of the current fixed-price incentive contract and that approximately two years will have added to the current development schedule. Lockheed announced a $300 million write off in the fourth quarter 1989 related primarily to the development phase of the P–7A.

Question. Is it true that the contractor "ceased work" on the main design effort last November?

Answer. Lockheed delayed the design work on the structural part of the P–7 while they conducted an exhaustive study of the program due to the potential weight increase problems. The Navy conducted its own independent design review at the same time. All other work on the program continued as normal. The result of the study indicated that the aircraft design is sound.

Question. Is there a weight problem?

Answer. Both the Lockheed and Navy independent review teams evaluated Lockheed's potential weight problem. Lockheed initiated a significant weight reduction effort to reduce aircraft weight and put weight controls in to the design effort. At this time, weight is under control with a potential weight increase of 3 to 4 percent. The aircraft will meet all operational requirements with this weight increase.

Question. What are the current first-production and IOC (Initial Operational Capability) estimated dates, and how do they compare to the original plan?

Answer. Contractually our first production option must be exercised in FY 1992. At least one aircraft must be procured to preserve the remaining options. We are still evaluating the best procurement profile within the current options. Impact on our planned ——— has not yet been determined.

Question. How much of the aircraft design was originally thought to be common with the P–3, and what is really happening now?

Answer. Lockheed predicted that the P–7 would be approximately 30 percent common with the P–3. The NAVAIR estimate was lower due to Lockheed's proposed producibility changes. The present P–7 design is essentially a new aircraft with only approximately 3 percent commonality with the P–3.

Question. What are the Navy plans to adjust the fixed-price development contract a result of these problems?

Answer. The FPI development contract has a ceiling price of $750 million. The Navy intends to execute the present contract staying within the bounds of that contract. The Navy is evaluating any contractor proposed changes to determine how they might affect the aircraft performance.

Question. Navy has "not to exceed" contract options for P–7 production at the approximate unit price of $38 million. The contractor is reported to be seeking relief from the contract at a price of $62 million. What plans does the Navy have to modify P–7 fixed price production contract options?

Answer. Lockheed is conducting an exhaustive rebasline effort on the entire P–7 program to provide the Navy a latest revised estimate for the production program. Lockheed has projected that the cost of the production aircraft will increase. The Navy has not received a final cost estimate from Lockheed at this time. The Navy does not intend to modify the P–7 fixed price production contract options. The Navy intends to stay within the ceiling price of the contract.

VERTICAL LAUNCH ASROC

Question. The Director of Operational Test and Evaluation (DOT&E) in the Office of the Secretary of Defense recently submitted his annual report to the Congress. It indicates the results of testing on the VLA system, which are not encouraging.

Please describe the results of the developmental and operational VLA test firing conducted last year.

Answer. Based on the results of OT-IIA, OPTEVFOR made the assessment that———.

Question. Of the seven missile firings, how many were considered to be "completely successful?" What percentage is this?

Answer. ———.

Question. What are the limitations of the MK-46 torpedo which is a component of the current VLA system?

Answer. The VLA with the MK-46 torpedo is an all weather, intermediate range ASW weapon capable of handling the majority of targets expected to ———.

The MK-50 torpedo offers a greater acquisition range ASW weapon with improved warhead performance.

Question. How much is budgeted in fiscal year 1991 to begin integration of the MK-50 torpedo into VLA?

What is the total development cost of this proposal?

Would this action be necessary if the Navy had not cancelled Sea Lance?

Answer. $30 million FY 1991. Total development cost for VLA/MK-50 is estimated at $175 million.

No.

Question. A recent press article states that Pentagon acquisition chief John Betti has suspended a VLA operational test scheduled for March "since previous test results were poor." Is this accurate?

Answer. No. Operational tests (OPEVAL) still on schedule, Decision to enter limited production was delayed until after OPEVAL.

Question. When are the next tests of VLA planned, and what are their objectives?

Answer. Next tests are OPEVAL—schduled for third/fourth quarter FY 1990.

To assess operational effectiveness and suitability.

SEA LANCE

Question. The current budget proposes to cancel Sea Lance, a critical ASW weapon due to its extended stand-off range and its ability to be launched from submarines, as well as surface ships.

What investment has the taxpayer made in Sea Lance through fiscal year 1990?

Answer. $519.4 million has been spent on the Sea Lance program through FY 1989. The FY 1990 Congressional authorization was for $127.8 million of which $81.5 million has been allocated from the FY 1990 Sea Lance budget to include effort through 3 January 1990, continuing tasks and termination expenses. As of February 28, 1990, $60.6 million had been obligated.

Question. Is there another existing ASW weapon that can match the maximum range of Navy ASW sensors other than Sea Lance?

Discuss the range and speed of existing Navy torpedoes compared to those planned for Sea Lance.

Explain how the Navy's objective for Sea Lance to counteract enemy standoff weapon proliferation will be achieved.

Answer. There is no singular ASW weapon that match the maximum range of Navy sensors. The Sea Lance ASW standoff weapon is simply a delivery system for a lightweight ASW torpedo. There are, however, numerous other weapon systems capable of performing the Sea Lance requirement of ASW weapon delivery at maximum sensor range, specifically, Naval ASW aircraft.

Since Sea Lance is only a delivery system the range and speed of the MK-50 torpedo is extended by the range and speed of Sea Lance. Therefore, a comparison of Sea Lance capabilities to existing torpedoes is not germane.

Enemy standoff weapon proliferation is of limited concern because of the present capability of existing torpedo weapon systems and the acoustic advantage maintained by U.S. submarines to provide a covert offensive strike.

Question. Does the Navy plan to develop some new weapon in Sea Lance's place? What costs would be involved?

Answer. The MK 50 variant for Vertical Launch ASROC is one of several options that are being studied as a replacement to provide surface ships with an intermediate range ASW capability. No detailed information is available at the present time.

Question. Did the Navy propose to OSD to cancel Sea Lance, or was it directed on you?

Answer. The Navy recommended Sea Lance for termination as a means of supporting the program adjustment proposals directed by OSD during preparation of the amended budget submission for FY 1991. OSD removed all Sea Lance funding in FY 1991 and out with the submission of the FY 1991 President's Budget. Navy then directed the termination of the program on December 29, 1989 and recoupment of FY 1990 funding in excess of program completion and termination requirements.

Question. A recent press article suggests that Navy's concurrence with the proposal to terminate Sea Lance "could mean the Service has concluded that ASW sensors cannot prosecute submarine targets at extended ranges. If true, the cost-effectiveness of submarines as antisubmarine platforms has now decreased." Please comment.

Answer. The decision to terminate Sea Lance development was not based on the ability to target or any mitigation of the requirement. The decision was based on the affordability of this weapon system which on a priority basis of ASW improvements could not compete with efforts such as sensor and combat control system upgrades. Sea Lance would have provided increased flexibility in attacking distant targets, however, existing ASW weapons and delivery systems are sufficiently capable of conducting the ASW mission.

Question. What are the termination costs for Sea Lance?

Answer. The termination liability for the Sea Lance Program is $38.8 million. These funds will be distributed among the major contractors, Boeing Corporation (for further distribution of subcontractors), Martin Marietta Corporation, FMC Corporation and Vitro

Corporation, and Navy laboratories (Naval Underwater Systems Center and Naval Ocean Systems Center).

DIRECTED ENERGY WEAPONS/ASAT

Question. The Army and Air Force are doing research into directed energy weapons for ASAT purposes. The Army has been designated by OSD to be executive service for the near-term kinetic (missile) ASAT, but who will be chosen to develop the longer-term directed energy ASAT has not yet been determined.

Although the Navy's proposal for the kinectic ASAT was not chosen by OSD, what was the Navy's proposal and what advantages did you think your approach offered?

Answer. The Navy's Sea-Based KE ASAT concept consisted of a three stage rocket and a visible sensor based in existing Vertical Launch System (VLS) tubes on surface ships. The Navy Sea-Based concept would provide a worldwide distribution of the ASAT capability ensuring survivability, flexibility responsiveness, and political acceptability. The Sea-Based concept would be integrated into existing naval forces utilizing existing personnel, launchers, and infrastructure.

Question. What work is Navy doing in directed energy research? Is this work solely for ASAT applications?

In what other roles would directed energy weapons have utility for the Navy?

Answer. The Navy is investing 6.1/6.2 tech base funds to develop the technology and explore the military utility of three forms of directed energy: High energy lasers, high power microwaves, and charged particle beams. Specific R&D efforts in each DE technology area are:

High Energy Laser. Solid window material development to provide environmental protection for the exit aperture of a laser beam director.

Other research is being focused in the areas of ———.

High Power Microwaves (HPM). Tests of foreign and US missiles to determine ———.

Development of ——— for weapon applications.

Charged Particle Beam. Development of ———.

Particle beam propagation experiments.

—No DE research work is being conducted solely for the ASAT applications.

—DE weapons would be used in the Navy for anti-ship missile defense.

Question. What plans does Navy have to participate in the OSD sponsored competition between the Services to develop directed energy ASAT weapons?

Answer. Navy has no plan to participate in any competition to develop a directed energy ASAT weapon. Navy is assisting in the upgrades to the MIRACL High Energy Laser, located at White Sands, NM, to develop a potential near term ASAT capability. This is not a Navy program and there are no Navy funds to support this effort. All funding for this development is being provided by OSD.

Question. How much is budgeted by the Navy in fiscal year 1991 for directed energy research, and how will these funds be used?

Answer. $6.916 million is being budgeted by Navy in FY 1991 for DE research in the following areas:

	Millions
Laser Technology	$1.821
High Power Microwave	2.380
Charged Particle Beam	2.715

Additionally, the following directed energy efforts are being developed by various Navy Laboratories and are funded solely by the Strategic Defense Initiative Organization with no Navy funds provided (FY 91 Dollars). ———.

Question. Explain how the Navy's approach to directed energy ASAT differs from those of the Army and Air Force.

Answer. Navy has no plan to develop directed energy ASAT weapons.

Question. What Navy requirements would be met by a directed energy ASAT system that cannot be met by the kinetic energy system?

Answer. Navy requirements are to ———. Either kinetic energy or directed energy ASAT weapons could satisfy this requirement.

T-45 AIRCRAFT DEVELOPMENT PROBLEMS

Question. In last year's Navy R&D hearing, we discussed the development problems which had surfaced in the T-45 program that affect the design of the aircraft.

Please describe for us the main technical problems that became evident through flight testing.

Answer. The main technical problems found during initial flight testing can be categorized into five flying qualities and performance areas: Longitudinal control system (LCS); Aircraft Performance (engine); Abrupt Pitch Change with Speedbrake Operation; Lateral/Directional Stability; and Stall performance.

Question. What is the status of the "fixes"? Have they all been identified? When will they be fully flight tested? Is a bigger, higher-thrust engine required?

Answer. Corrections for each deficiency have been identified and are being installed in the first prototype aircraft at this time. Contractor flight testing is scheduled to begin in May and Navy reevaluation is planned for September and October of this year. The contractor has installed an upgraded version of the Rolls Royce Adour engine (MK-871) which provides 30% more thrust on a hot day. This engine is 80% common with the original MK 861 engine planned for the T-45A but will have better life characteristics.

Question. Is there a funding dispute between the Navy and the contractor over who pays for fixing these problems?

Answer. The Navy's position is that the aircraft presented for testing has not yet met performance specification requirements delineated in the contract. The contract has not been changed and the contractor is working at this time to meet our specification. Consequently, any nonrecurring costs incurred to design and install the aircraft corrections on prototype and pilot lot 1 production aircraft are considered to be within the fixed price contract. The contractor has indicated by a short letter that he intends to submit a claim for some of the cost for deficiency correction. We have not yet received any detailed cost proposal for such a claim.

Question. What is the effect on the fixed priced development contract?

Answer. At this time, there is no effect on the development contract for the major deficiencies. After initial testing all aircraft corrections were analyzed by the Navy for responsibility. Several of the minor cockpit type corrections were determined to be shared by the contractor and the Navy. The costs were negotiated in August 1989. The FSD contract impact is $1.7 million RDT&E.

Question. Explain how the contractor's plans to move the production line from California to Missouri impact the development program and its cost/schedule.

Answer. The Navy feels this move will cause a short-term perturbation to production but will result in long-term benefit to both the Navy and McDonnell Douglas. Initial impact is stopping the pilot lot deliveries after the second production aircraft and then resuming production in St. Louis after final configuration is productionized. This has little impact on the Training Command in that they will receive fully configured operational aircraft at approximately the same time as previously planned. This means the IOC is delayed but the more meaningful ready-for-training (RFT) date is approximately the same. Further, this move and delayed production eliminates the need to have an extensive retrofit program which was required in the previous plan. We do not anticipate any additional cost for this move and in fact will seek consideration for the later delivery schedule. We do not feel there will be any significant impact to the developmental effort since the test sites are not affected by the move.

Question. How much is requested in 1991 for T–45 R&D, and how will these funds be used?

Answer. The request is for $14.916 million of which $7.633 is to pay for Navy responsible corrections of development and operational deficiencies anticipated during follow-on testing (major contract). The additional $7.283 is for Navy in-house effort and for Navy support of the flight test program at NATC Patuxent River, Maryland.

Question. Provide for the record a detailed comparison of the T–45 contract cost to the budget estimate in each fiscal year 1989–1991? Explain the differences in detail.

Answer. The 1989 budget was $91.234 of which $85.3 was for major contract and $5.9 for Navy in-house effort and flight test support. There is a contract modification for $1.7 million in process for Navy responsible deficiency corrections. The 1990 budget was $22.475 and all went to the major contract. Navy in-house effort and flight test support has been funded through below threshold reprogramming of $3.9 million. The 1991 budget and utilization are as answered to the previous question.

Question. Has the T–45A in any configuration been subjected to high angle of attack/spin testing. If not, under current plans how many production aircraft are planned to be under contract prior to successful accomplishment of such testing?

Answer. At this time no high angle of attack/spin testing has been completed. This effort is normally scheduled towards the end of the flight test program. Consequently, 72 aircraft will be under contract by the time this testing is completed.

MARINE CORPS MEDIUM LIFT HELICOPTER REPLACEMENT (MLR)

Question. Along with DOD's proposal to terminate the V-22, the fiscal year 1991 budget proposed R&D for helicopter alternatives.

The Committee understands preliminary finds in draft form of the Institute for Defense Analysis (IDA) study on the V-22 and alternatives to it have been made available to the Defense Department. What are the major conclusions of this analysis?

Answer. We have not seen the preliminary findings. The DON representative to the OSD, Executive Steering Committee (Brigadier General Blades/USMC) has indicated that the study is progressing well and should satisfy the Congressional tasking to assess all reasonable V-22 alternatives. The preliminary draft report to Executive Steering Committee is scheduled for April 16.

Question. If the Congress were to accept the Defense Department's proposal to terminate V-22, what would be the Department of the Navy's plan to either upgrade the CH-46E assault helicopter or to develop/buy a new helicopter? Discuss:

—service life extension of the CH-46E;
—new production of CH-46Es;
—development of a new CH-46E's derivative, called CH-46X;
—remanufacture of CH-46's into a new configuration; or
—development of a stretch version of the Army's UH-60 black hawk.

Answer. Department of Navy is currently conducting a one-year Service Life Assessment Program on the CH-46E to determine the dynamic components that need to be included in a Service Life Extension Program (SLEP).

The development/procurement of any alternative medium lift helicopters is pending the results of the V-22 Cost and Operational Effectiveness Analysis (IDA study).

The CH-46E (X) or other new helicopter options mentioned as alternatives are being addressed as DON and HQMC develop plans for the 1992 budget.

Question. What is budgeted in fiscal year 1991 RDT&E for programs that are alternatives to the V-22?

What are the total development, total procurement, and total program costs of these alternatives?

Answer. There is $51 million in the FY 1991 RDT&E Budget for V-22 alternatives. The total program cost for these alternatives will be determined based on the results of the V-22 COEA.

AN/SQQ-89I

Question. SQQ-89I is an improved ASW system that integrates advanced sensors and weapons control systems with advanced acoustic data processing and displays for use on certain surface ships. It is reported to have slipped 6 years from original plans.

What is the status of the SQQ-89I development program?

Answer. The competitive Design Definition Phase is complete. Proposals for the Full-Scale Development Phase are currently being evaluated. A Defense Acquisition Board Milestone II review is scheduled for mid-1990 and Full-Scale Development contract awards are planned for award late FY–1990.

Question. How much is requested in fiscal year 1991 for this initiative, and how will the funds be used?

Answer.

AN/SQQ–89 improved project budget data working sheet P.E. 0604713

[Dollars in thousands]

Activity:	*FY–91*
Labs/Field Activities	12,200
Support	2,312
Long-Lead Government Furnished Material	25,870
Prime Contractors:	
Block II Full-Scale Development Contract	64,000
Block III Critical Design:	
G.E. Team	6,750
Westinghouse	6,750
Total	117,882

Question. A recent press report indicates that the Navy is reconsidering its plans to backfit the system on the current fleet of Navy surface combatants. What are your plans in this regard?

Answer. The Navy plans to equip all ASW capable surface combatants with variants of the AN/SQQ–89 Improved system. The Navy recently redefined which classes of ships will receive the Block II as a backfit and which classes of ships will receive the Block III as a forward fit.

Question. What is the total development cost for SQQ–89I?—Provide for the record all R&D funding by fiscal year and program element.

Answer. Total Development Cost: $1,555.9 million.

[In millions of dollars]

Program element	Fiscal year— 1988	1989	1990	1991	To complete	Total
0603553N	20.1	37.5	11.7	0	N/A	69.3
0604713N	0	0	94.9	122.6	1,300.2	Cont.

Question. It is reported that a recent 3 month slip occurred in sending the SQQ–89I RFP to industry. Is this accurate, and if so what is the effect on the planned consumption of R&D funding?

Answer. Receipt of Full-Scale Development proposals was originally planned for January 3, 1990. However, due to administrative issues and a request by one of the contractors for more time, the proposals were actually received March 8, 1990 about 2 months later than planned. This has caused the anticipated contract award date to slip. This delay will not affect the planned consumption of R&D funding.

Question. Provide for the record specific technical details to quantify improved performance goals compared to current systems as objectives for SQQ–89I.

Answer. The AN/SQQ–89 Improved Surface Ship ASW Combat System includes the following new capabilities which do not exist on current systems. ———.

c. Active Classification capability—provides a reduced false alarm rate using the active subsystem.

d. Torpedo Detection—provides the processing capability to ———.

e. Contact Data Management and Correlation—enhanced ability to track contacts, correlate acoustic contact data with other sensor data, and provide fire control solutions.

f. Acoustic Intercept—provides the ability to ———.

Additionally, the AN/SQQ-89 Improved System includes the following capabilities which are equivalent or similar to existing systems.

a. Passive Towed Array—provides additional array gain and expanded capabilities over the AN/SQR-19 surface ship towed array sonar to all full-spectrum processing of passive signals and the reception of multistatic active signals.

b. Active Direct Path or Mid-Frequency Sonar—provides the equivalent capability of existing surface ship active sonars. If already installed, portions of these systems will remain on board to interface directly with AN/SQQ-89 Improved system.

Question. Explain Navy plans for international cooperative codevelopment for this program.

Answer. There are no known foreign systems in development or production that will satisfy all requirements of the AN/SQQ-89 Improved system. No allied nation has expressed an interest in producing a system with all the AN/SQQ-89 Improved capabilities. However, several Allies have indicated interest in cooperation at the experimental level under existing Information Exchange Program agreements and Data Exchange Agreements. The Navy is pursuing a number of programs involving ——— with allied nations.

Question. The DOT&E annual report to Congress indicates there is no approved operational test program for this system. Why, and when will one be available?

Answer. The AN/SQQ-89 Improved Test and Evaluation Master Plan is in final approval cycle and will be approved prior to the Defense Acquisition Board Milestone II. The AN/SQQ-89 Improved is a complex ASW Combat System. Accordingly, its coordination and review has taken a considerable amount of time.

F-14 AIRCRAFT

Question. The Budget requests $121 million for development of F-14 upgrades in fiscal year 1991.

What is the requirement for and strategy for meeting upgrades to the F-14?

Answer. Currently planned upgrades to the F-14D have been grouped together in an effort called pre-deployment update. Included in the planned update are JTIDS fighter-to-fighter data link, Radar/ECCM improvements, sensor control mechanization, AMRAAM and HARM integration. The plan was to provide these required capabilitieis as one software update prior to first deployment of the F-14D. Because of the FY 1990 congressional reduction of funding for this program some of these capabilities will be delayed beyond first deployment.

Question. The Committee understands that the Navy restructured the "Predeployment update" program from a year ago. What is different now (a year later) in this initiative?

Answer. Due to the Congressional budget reduction in FY 1990 the scope of work has been dramatically reduced. The effort to be performed by the contractor has been de-scoped with increased government risk and the concentration of work has shifted to the Navy field activity at PMTC. There is a potential delay in the introduction of the first pre-deployment update tape. Integration of HARM and AMRAAM has been delayed.

Question. For the record, compare the total development cost current estimate for the PDU to last year's estimate.

Answer. The current estiamte for the development cost of the restructured PDU is $197.8 million. Last year's estimate for the total development cost for PDU was $245.8 million.

Question. How much more R&D on the F-14 is envisioned beyond fiscal year 1991, and for what purpose?

Answer. The current profile for R&D for fiscal year 1991 through 1994 is $180.1 million. Included in this total is the PDU program, correction of OPEVAL deficiencies, and follow-on improvements.

Question. How does this fit into your plan to terminate new production of aircraft.

Answer. The F-14D remanufacture program will provide the vast majority of F-14D capability to the Navy fighter fleet. Termination of F-14D production after FY 1990 provided only 37 new F-14D aircraft; however, the F-14D remanufacture program is planned to provide 400 aircraft with the identical capability as the new production aircraft.

Question. What efforts could be done to reduce the radar signature of the F-14 to give it somewhat "lower observable" features?

Answer. There are a number of aircraft "treatments" and radar absorbent materials which could be used to give the F-14D a "lower observable" feature.

Question. If feasible, how could this be retrofitted into the existing fleet of aircraft?

Answer. Treatments could be included during the F-14D remanufacture process as F-14A aircraft are converted to an F-14D model.

STANDARD MISSILE

Question. The budget requests about $45 million to continue development of upgrades to the Standard Missile (STD MSL), which is a surface-to-air or surface-to-surface tactical missile.

What is the requirement for and strategy for meeting upgrades to the Standard Missile?

Answer. Strategy is to continue to evolve STD MSL performance to counter an evolving threat. ———.

Question. What is the total development cost?

Answer. $367.7 million (then year $) for BLK IV.

The $231 million firm, fixed price development contract is included in the above total.

Question. What is the inventory objective?

Answer. The approved inventory objective for SM-2 BLK IV is ——— missiles.

The approved inventory objective for SM-2 BLK IIIB is ——— missiles.

Question. What specific improvements in missile performance are being sought?

Answer. Performance parameters being enhanced in the new design are additional ———.

Question. Will the AEGIS extended range missile (Standard Missile 2, Block IV) serve as a replacement to current inventory missiles? If so, which ones?

Answer. Block IV is not a direct replacement for current inventory.

Block IV provides for the continued evolution of STANDARD missile to counter the evolving threat. It retains the performance capabilities of SM-2 Blocks II, III and IIIA missiles.

Question. The Committee understands there are technical problems with the missile fuze, causing the development program to slip. Please explain the problem and the impact on program schedule.

Provide for the record detailed milestones as currently planned compared to original program estimates.

Answer. ———.

AIWS

Question. The Advanced Interdiction Weapons System is a stand-off missile aimed at replacing a number of different munitions.

What is the requirement and acquisition strategy for developing AIWS?

Answer. The AIWS requirement is an integral component of the Navy Strike/Anti-Surface Warfare Master Plan which lays out overall, long range warfighting and acquisition strategies. This plan identifies the need to replace the current inventory of interdiction weapons (Mavericks, Laser Guided Bombs, Skipper, and Walleye). AIWS will alleviate the limited capabilities inherent in these existing systems and provide a low cost, launch and leave, stand-off capability for Navy and Marine Corps aircraft to attack well defended targets in day, night, and less than ideal weather conditions.

In order to best manage development risk, provide a low cost inventory fill weapon, and provide an early initial operational capability, the AIWS requirement dictates development of a "baseline" weapon effective against fixed, area targets. However, to provide effectiveness against the entire AIWS target set, improvements to the baseline weapon will be required, such as the addition of a terminal seeker and data link. With the added cost of these improvements comes the added value of increased probability of kill and the capability to attack moving and hard targets. The AIWS development strategy calls for preplanned product improvement (P^3I) to be considered upfront in the baseline design. Additionally, a focus of the AIWS strategy is affordability with low unit procurement cost goals for both baseline and P^3I.

The AIWS baseline program is currently in month 12 of an 18-month Demonstration/Validation (DEM/VAL) contract with three competiting contractor teams: Boeing/Raytheon, McDonnell Douglas/Hughes, and Texas Instruments/LTV. A full and open competition will be conducted to select a single team for the next contract phase which includes FSD for the baseline weapon and options for baseline LRIP (Low Rate Initial Production) and a P^{3}I DEM/VAL. Teaming has been selected to ensure the earliest availability of two qualified producers for later competition in production.

Question. What are the key milestones?

Answer. Milestones for the baseline AIWS are as follows: Milestone I (commence DEM/VAL)—fiscal year 1989; Milestone II (commence Full Scale Engineering Development)—Fiscal Year 1991; Milestone III A (Low Rate Initial Production)—Fiscal Year 1995; Milestone III B (Full Rate Production)—Fiscal Year 1996;

Current plans are for a P^{3}I DEM/VAL to commence in FY 1994 with a Milestone II decision in FY 1995.

Question. Please explain specifically how the AIWS "baseline" configuration under development will be advantageous to the Navy and how it provides enhanced military capability over the currently deployed Skipper II, Walleye, Paveway, and Maverick missiles.

Answer. AIWS will provide improved warfighting capabilities, particularly increased standoff launch ranges to minimize exposure of attacking aircraft to enemy defenses and the capability to attack several targets on one pass. Additionally, AIWS is being designed upfront to accept pre-planned product improvements to keep pace with the advancing threat. Improvements to older systems are technically difficult to implement and provide only a marginal performance increase in relation to the time and funds required. Also, AIWS will be designed and manufactured with state of the art components and technologies to enhance reliability and maintainability. An integral part of the Master Plan/AIWS strategy is to "neckdown" from several disparate systems to one common, baselined system to simplify logistics and training and to optimize the use of aircraft carrier magazine space.

Question. Provide a technical detailed comparison for the record.

Answer. Refer to Table 1.

Question. Also provide scheduled phase out of each of the above weapons and how the phase-in of baseline and P^{3}I AIWS versions mesh with those dates.

Answer. The Chief of Naval Operations has directed a study, to be completed not later than December 1, 1990, to develop recommendations for the optimum fleet introduction schedule for AIWS (baseline and P^{3}I). This implementation plan will be provided subsequent to completion of the study and prior to the AIWS Milestone II Review.

Question. What are the distinctions in expected military capability, mission requirements, operating costs, and survivability between the "baseline" and the "P^{3}I" versions?

Answer. The low cost AIWS baseline (submunition dispensing) weapon will effectively attack a significant target set such as ———. AIWS P^{3}I will provide increased accuracy, man-in-the-loop weapon control to impact for aimpoint selection and bomb impact assessment, a greater warhead penetration capability against hard targets, and enhanced probability of kill against both fixed and moving targets. The baseline/P^{3}I strategy is designed to maximize common hardware components between the two variants including a common airframe, common actuators, a common guidance computer, etc. P^{3}I unique components will most likely include addition of a terminal seeker, data link and insertion of a unitary warhead into the payload bay vice a submunition pack. This strategy is designed to minimize distinctions in operating and procurement costs.

Question. What is the total development cost of the baseline system, the P^{3}I system, inventory objective of each, average projected unit cost of each (in constant and then year dollars to include all costs associated with an all-up round)?

Answer. In then-year dollars, the total estimated development cost is $280.3 million for the baseline AIWS and $263.6 million for the P^{3}I variant. Navy warfighting requirements indicate a need for ———. The baseline Design to Cost (DTC) requirement is $58,600 per unit (FY 1990 dollars, recurring hardware costs only, excluding the cost of the warhead). The P^{3}I DTC requirement is $149,000. Warhead costs are estimated to be $6,000 for a unitary and $9,000 for a payload of submunitions.

Question. How many AIWS will be carried on Navy aircraft per sortie, and on which aircraft?

Answer. The maximum loadout for AIWS per sortie is ———.

Question. Provide for the record the funding in the five year defense plan for development and production of modifications to each aircraft platform that will carry AIWS.

Answer. There are no planned hardware modifications to any of the aircraft platforms. The AIWS weapon will be carried on a parent rack and will require 1553/1760 interface to pass targeting information from the aircraft to the weapon. The F/A-18 aircraft integration costs included in the five-year defense plan are indicated below. The amount shown reflects total integration costs including aircraft software modification. Efforts are continuing to further definitize aircraft integration costs. Cost for integration of AIWS on the A-6, AV-8B and the A-12 will be included in this effort. All aircraft integration costs will be briefed at the MS-II review and submitted as part of the FY 1992 President's Budget.

[Dollars in millions]

Fiscal year:	*F/A-18*
1991	1.08
1992	3.04
1993	3.10
1994	2.10

Question. Why would a SLAM missile P^{3}I not be an effective substitute for AIWS P^{3}I?

Answer. The SLAM is reserved for a relatively small set of high value targets due to its high unit cost. AIWS is being developed to complement the long range SLAM capability. The unpowered, lower cost AIWS is being designed as an inventory fill weapon system to effectively attack the numerous, less than high value tactical targets yet still maintain acceptable standoff for launch aircraft survivability. Low cost, high volume producibility to a focus of the AIWS program which cannot readily be accommodated with modification of the existing point design of the basic SLAM missile.

Additionally, the AIWS design for inherent growth potential is readily cited for possible enhancements, such as other warhead payloads to meet expanded Navy requirements or to meet the requirements of other services or our allies.

SIDEWINDER MISSILE

Question. The budget includes R&D funds to develop improvements to the Sidewinder missile, which has been a star performer in tactical air-to-air combat.

What are Navy plans to improve the performance of the Sidewinder missile, in a program called AIM-9R?

What specific changes in missile performance are you seeking to obtain?

Answer. The AIM-9R will significantly improve the acquisition range and IRCCM performance over that of the AIM-9M. The AIM-9R replaces the AIM-9M seeker.

Question. How much is requested in the fiscal year 1991 budget for AIM-9R development?

Answer. $26.5 million RDT&E and $7.0 million Weapon Procurement, Navy is requested.

Question. What is the total development cost for AIM-9R, and what is the projected impact on Sidewinder production unit prices?

Answer. The development cost is $197.5 million (TY$). Unit cost of AIM-9R retrofit kit is approximately $90,000 (TY$).

Question. Explain how the Air Force's AIM-9M upgrade program (called AIM-9M Plus) differs from the Navy's AIM-9R program.

Answer. At this time there is no Air Force AIM-9M+ program. The Air Force with Navy participation is exploring options for upgrading their large AIM-9M inventory at minimum cost. This exploration has been called AIM-9M+.

Question. Does the Navy have a requirement for AIM-9M Plus?

Answer. No. AIM-9R is the Navy's short range missile for the 1990's.

Question. Is the Navy participating in the Air Force's program?

Answer. There is no AIM-9M+ program, but the Navy is participating with the Air Force in exploring AIM-9M modifications.

Question. Is the Air Force participating in the Navy's program?

Answer. No. The Air Force is reviewing.

Question. For the record, provide the funding in fiscal year 1991 and in each fiscal year through 1996 for AIM-9M Plus by appropriation, fiscal year, and R-1/P-1 line item.

Answer. The Air Force will have to provide.

AIRBORNE SELF PROTECTION JAMMER (ASPJ)

Question. After nine years of development and testing, the Air Force has pulled out of the ASPJ program while the Navy wants to continue it. This is frustrating to Congress which for years has urged DOD to use common electronic warfare equipment on its tactical fighter aircraft.

What is the Navy's position on ASPJ and why does the Air Force's position differ?

Answer. The Navy has a valid requirement for the capability that ASPJ provides. The Navy does not have any alternative systems to ASPJ. The reason we have been given for Air Force's withdrawal from the program was affordability.

Question. How much has been spent to date to develop and test ASPJ?

Answer. Total R&D through 1990 is about $502 million. This includes development, aircraft integration and T&E. The split is very close to 50/50 Navy/Air Force. Two production funded contracts exist for about $680 million: production verification for 20 systems ($250 million); and Lot I 100 systems ($430 million). Production contracts contain ILS and warranties test equipments as well as system procurement.

Question. Does the Navy have any alternatives to ASPJ to protect its fighter aircraft?

Answer. No. ASPJ is needed to reduce aircraft attrition to acceptable levels; somewhere below 3%.

Question. Are there any funds requested in your fiscal year 1991 R&D budget to develop ASPJ system or component alternatives?

Answer. No. There are other systems being developed which complement ASPJ, but they are not alternatives.

Question. Describe the capability that ASPJ provides to a tactical fighter aircraft and the synergy between this system and other onboard electronic warfare systems.

Answer. The ASPJ provides pulse, continuous wave and pulse doppler jamming in response to multiple threat weapons simultaneously. The jamming affects the threat by introducing tracking errors in a gun director, prohibiting a firing solution in an air interceptor, and causing inaccurate missile guidance among other protection measures. The ASPJ complements other onboard EW systems such as the radar warning receiver which allows the aircrew to use tactics by providing threat warning and avoidance information and allows the crew to enhance the ASPJ jamming with maneuvers. Also, the dispenser ejects flares, chaff and decoys to affect specific threats which, when combined with jamming, add to confuse the total picture presented to the threat operators.

Question. Describe for the record in detail the programs and their associated fiscal year 1991 funds for tactical aircraft electronic warfare programs, to include where appropriate chaff and flares, towed decoys, expendable jammers, etc. Indicate how these programs relate to ASPJ.

Answer. The following Tactical Electronic Warfare programs are funded in FY 1991.

[In thousands of dollars]

RDT&E	Funding fiscal year 1991	Relationship to ASPJ
ASPJ P3I	$6,400	Provides a preplanned product improvement to ASPJ to enhance performance against projected threat improvements and monopulse.
AAED Towed	4,212	Will go on A–6E SWIP as part of IDAP (Integrated Defensive Avionics Program). ASPJ is not planned for A–6E SWIP. AAED and ASPJ would work synergistically to improve survivability if placed on the same platform.

[In thousands of dollars]

RDT&E	Funding fiscal year 1991	Relationship to ASPJ
ALR-67 Advanced Special Receiver (ASR)	15,954	An update to ALR-67 in development that will allow the Radar Warning Receiver (RWR) to be viable against the AD2000 threat. It will interface with ASPJ to share threat identification data. ASR is a passive receiver which provides the pilot with situation awareness and aids in expendables (chaff, etc.) deployment. It does not provide self-protection emissions.
IDAP	15,644	IDAP integrates the ALR-67 RWR, towed decoy, ALQ-156 missile warning system (MWS), ALQ-126B and chaff/flare dispenser (ALE-39 or ALE-47) on the A-6E SWIP into a cohesive suite. The ALQ-156 allows the system to launch flares/chaff only when a missile is approaching every few seconds, conserving limited onboard flare/chaff assets. The A-6E SWIP will not receive ASPJ. The ALQ-156 MWS will improve survivability of any aircraft and could be integrated with ASPJ.
GENEX	1,000	An RF expendable decoy which is launched by the ALE-39 or ALE-47 decoy dispenser and responds to a certain class of missiles. It can be used on any TACAIR aircraft to improve survivability.
BOL-CHAFF	1,000	An FWE program which adds a chaff launching capability to the LAU-7 missile launcher, thus adding increased chaff carriage capability freeing up ALE-39 space to carry more flares. Though independent of ASPJ, the use of both enhances survivability of each separately.
ALE-47	4,800	A joint development with the USAF to develop a replacement for the ALE-39/40 expendables dispenser (chaff/flares/RF expendables). The advantage over the ALE-39 is that the ALE-47 can receive inputs from other sensors and systems onboard the aircraft (RWR, Inertial Nav, missile detector, etc.) and optimize dispensing of the limited available expendables carried onboard.
APN-5:		
ALR-67	59,301	Similar to ASR but much less capable, it shares threat ID information with ASPJ over the data bus. It requires ASR (now in development) to keep pace with current and projected threats.
OPN:		
Flares	21,065	No relation or reliance on ASPJ which addresses RF threats.
Chaff	2,438	Provides alternate target for RF guided threats. It has limited autonomous capability against modern missile systems. If ASPJ is onboard, chaff will enhance survivability.

Question. The Director of Operational Testing's annual report to Congress indicates a number of technical problems needing further work in the ASPJ development program. For the record, please indicate Navy's plans to address these issues.

Answer. The lack of AN/ALQ-165 effectiveness asserted in the report was generally traced to the system's generation of false threats to which the system responded. The AN/ALQ-165 was effective; however, poor design ot the test criteria precluded an accurate judgement of system effectiveness. New measures of effectiveness, scenarios and standard test procedures are being developed to prevent inaccurate judgement of the production verificaton (PV) model intended for use in future tests.

The built-in test (BIT) was not operable on the runway at China Lake until the power setting was increased to 75%, an unacceptable situation on a carrier deck. This has been corrected by the addition of a "no-air" BIT for the PV system. A no-air BIT can be run in the aircraft without cooling air.

The reliability problem associated with the full scale development model used in previous tests were well known prior to the start of testing and the principal reason for shifting future tests to a PV model. An aggressive reliability program is in place for the PV model with a 2000 hour reliability growth test planned. Early indications of its reliability are very encouraging.

AIRBORNE LOW FREQUENCY SONAR (ALFS)

Question. The Committe expressed concern last year about the ALFS program which is intended to develop a low frequency dipping sonar for ASW missions in SH-60 helicopters. ALFS could be a $1 billion program.

What is the status of the ALFS development program?

Answer. A request for proposals (RFP) for full scale engineering development was released in February 1990 with proposals due in April. Prior to RFP release, five contractor teams conducted demonstrations of ALFS technology which demonstrated that performance gains over existing sonars were achievable at low risk. Contract award is expected in August.

Question. The Committee understands that the Navy has delayed the program to restructure the RFP to ensure maximum competition in this program. Please explain what is being done to meet our concerns in this regard.

Answer. Prior to release of the RFP in February, a Request for Information (RFI) and a Draft RFP were released in order to solicit contractor input to ensure to the maximum extent possible an equitable competiton could be held. A cost plus incentive fee contract is planned for development. Two production options are also included with not to exceed prices requested. The Enhanced Modular Signal Processor will be supplied as Government furnished equipment.

Question. There was a question of the Navy's commitment to fund this program in the outyears. Explain the recent memorandum of understanding between organizations within the Navy to meet this concern, and describe the outyear funding of this program today.

Answer. The ALFS program is fully funded. OP-03 and OP-05 signed a memorandum of agreement to fund ALFS development. Subsequent to this memorandum, funding offsets were identified to fully fund the program.

(Funding is described in the FY 1991 R&D Descriptive Summary)

Project element	Title	Fiscal years—			to complete
		1989 actual	1990 estimate	1991 estimate	
0604219N	CV Helo Avionics				
W0485					
RDT&E		0	11,788	12,708	Cont.

Project element	Title	Fiscal years— 1989 actual	1990 estimate	1991 estimate	to complete
APN-1, No. 20/21		0	0	0	370,004
0604212N	LAMPS Imp				
W1707					
RDT&E		0	0	6.1	Cont.
APN-1		0	0	0	0

Question. Into what aircraft does the Navy plan to place the ALFS, once it is successfully developed?

Answer. The lead platform for ALFS is the SH-60F CV Helo. Incorporation of ALFS is planned for the SH-60B as part of a future block upgrade. Options are included in the contract for FMS and SH-2G applications should they arise.

ADVANCED TACTICAL SURVEILLANCE (ATS) SYSTEM

Question. While the Budget requests only $1.5 million this year to study ATS, the Navy plans to spend over $250 million through fiscal year 1994 to begin full scale development of a new aircraft by that time. The Committee denied this program a year ago.

Please describe the ATS requirement, program goals, and acquisition strategy.

Answer. The Navy is facing the commencement of retirements of a number of aircraft in the late-1990's and early 2000's (E-2, S-3, ES-3 and EA-6B). The Navy is looking at both an affordable as well as an innovative operational approach to replacing the missions performed by these aircraft. The goals are an affordable, timely program to meet the projected threats. During concept exploration, manned and unmanned platform/sensor options will be investigated.

Question. Is it possible to replace 4 existing aircarft with a single system: E-2C, ES-3, S-3 and EA-6B?

Answer. It is possible, but the approach must be bounded by affordability. Advances in data fusion and processing technology can greatly reduce the weight and volume of avionics necessary for these missions. ATS is viewed as a cooperative warfare system that fuzes data from many other sources, rather than acting as an isolated collector.

Question. What are your plans for using a stealth A-12 variant to meet this requirement?

Answer. The Navy has not selected any single option, but would definitely prefer a derivative aircraft, such as the A-12, if a platform is required, because of commonality and affordability.

Question. What total development and total program costs are you using internally as estimates: how big is this program?

Answer. We are looking at a whole range of development options and costs. However, the range of options is so great that no single value has any merit at this time. To get this information, the Navy desires to start concept exploration to define options and costs. CNA is completing a study requested by the Congress on the feasibility of ATS concept.

[CLERK'S NOTE.—End of questions submitted for the record.]

THURSDAY, MAY 3, 1990.

RESEARCH, DEVELOPMENT, TEST AND EVALUATION, AIR FORCE

WITNESSES

HON. JOHN J. WELCH, JR., ASSISTANT SECRETARY OF THE AIR FORCE FOR ACQUISITION

LT. GEN. THOMAS R. FERGUSON, JR., PRINCIPAL DEPUTY ASSISTANT SECRETARY FOR ACQUISITION

INTRODUCTION

Mr. MURTHA. The committee will come to order.

We want to welcome Secretary John J. Welch, Jr., Assistant Secretary of the Air Force for Acquisition, and General Thomas R. Ferguson to the committee today to discuss RDT&E issues for the Air Force.

We will put your entire statement in the record; if you will summarize for us, we will get right to the questions.

Mr. Welch.

SUMMARY STATEMENT OF MR. WELCH

Mr. WELCH. We are happy to be here this morning, Mr. Chairman.

Since we have put a statement in the record, I think we are prepared to really address ourselves to the questions in the specific areas of interest you have this morning.

Mr. MURTHA. I appreciate that.

[The joint statement of Mr. Welch and General Ferguson follows:]

DEPARTMENT OF THE AIR FORCE

PRESENTATION TO THE COMMITTEE ON APPROPRIATIONS

SUBCOMMITTEE ON DEFENSE

UNITED STATES HOUSE OF REPRESENTATIVES

SUBJECT: AIR FORCE RESEARCH, DEVELOPMENT, TEST AND EVALUATION

STATEMENT OF: THE HONORABLE JOHN J. WELCH, JR.
ASSISTANT SECRETARY OF THE AIR FORCE
(ACQUISITION)

LIEUTENANT GENERAL THOMAS R. FERGUSON, JR
PRINCIPAL DEPUTY ASSISTANT SECRETARY OF THE
AIR FORCE (ACQUISITION)

MAY 1990

NOT FOR PUBLICATION UNTIL RELEASED
BY THE COMMITTEE ON APPROPRIATIONS,
HOUSE OF REPRESENTATIVES

Biography

United States Air Force

Secretary of the Air Force, Office of Public Affairs, Washington, D.C. 20330-1000

JOHN J. WELCH JR.

John J. Welch Jr. is the assistant secretary of the Air Force for acquisition. He is responsible for Air Force research, development and acquisition activities, and is the Air Force acquisition executive. He is also chairman of the F-16 Multinational Fighter Program Steering Committee and is the senior United States delegate to the North Atlantic Treaty Organization advisory group for aerospace research and development.

Mr. Welch was born Aug. 23, 1930, in Cambridge, Mass. He graduated from the Massachusetts Institute of Technology in June 1951 with a bachelor of science degree in engineering. He then joined the Chance Vought Corp., Dallas, as a junior engineer on aircraft and missile systems. Mr. Welch held a variety of engineering and program management positions in flight test, missile operations, anti-submarine warfare, advanced programs, and aircraft and missile product development. In March 1965 he became a Ling-Temco-Vought vice president and directed all space defense systems programs. He later became the vice president and manager of all programs and functional organizations at the Missiles and Space Division.

In August 1969 Mr. Welch became the chief scientist for the Air Force and received the Exceptional Civilian Service Award. Upon his return to Ling-Temco-Vought in September 1970, he became vice president of programs for Ling-Temco-Vought Aerospace. In 1974 he became a corporate vice president. He was promoted to senior vice president in 1975 and was responsible for all corporate business development efforts. He assumed his present duties in October 1987 after having been appointed by President Reagan and confirmed by the Senate.

Mr. Welch has held a variety of consultant positions with the Defense Science Board, Army Science Board, National Academy of Sciences Naval Studies, Air Force Scientific Advisory Board, and Air Force Systems Command division advisory groups. He has been a member of the Defense Systems Management College Board of Visitors; MIT Educational Council; and the Center for Strategic and International Studies Committees on Technology Transfer and Defense Futures. Mr. Welch is a registered professional engineer in Texas. He also belongs to several professional, scientific and civic organizations, including the American Astronautical Society, American Society of Mechanical Engineers and the Air Force Association.

Mr. Welch and his wife, Patti, have a son and three daughters.

(Current as of December 1987)

LIEUTENANT GENERAL THOMAS R. FERGUSON JR.

Lieutenant General Thomas R. Ferguson Jr. is principal deputy, Office of the Assistant Secretary of the Air Force for Acquisition, Washington, D.C.

General Ferguson was born Aug. 26, 1935, in Cleveland and graduated from Washington Irving High School, Clarksburg, W.Va. He earned a bachelor of science degree in chemical engineering from West Virginia University in 1957 and a master of science degree in metallurgical engineering from Ohio State University in 1968. The general completed Squadron Officer School in 1962, Air Command and Staff College in 1973 and the Industrial College of the Armed Forces in 1979.

He was commissioned through the Air Force Reserve Officer Training Corps program in 1957 as a distinguished graduate. The general received his pilot wings at Vance Air Force Base, Okla., and then was assigned to Ellsworth Air Force Base, S.D., where he flew B-52s. His final B-52 missions were flown from Guam, in support of Southeast Asia operations.

In August 1968 General Ferguson was assigned to Headquarters 7th Air Force, Tan Son Nhut Air Base, Republic of Vietnam, where he served in several positions under the director of operations. He returned to the United States in September 1969 and was assigned to Air Force Materials Laboratory, Wright-Patterson Air Force Base, Ohio, as a technical manager in the Systems Support Division.

From June 1973 to June 1976 the general served as program element monitor within the Office of the Deputy Chief of Staff, Research and Development, Headquarters U.S. Air Force, Washington, D. C. He then moved to Headquarters Air Force Systems Command, Andrews Air Force Base, as chief of the Flight Vehicle Division, Directorate of Science and Technology. He later served as chief, Avionics and Weapons Division. After graduation from the Industrial College of the Armed Forces in June 1979, the general returned to Air Force Systems Command headquarters as deputy to the director of science and technology.

In October 1981 he returned to Wright-Patterson Air Force Base as assistant deputy for development planing at Aeronautical Systems Division. From August 1982 to July 1984 he served as director of the AGM-65 Maverick Missile System Program Office under the deputy for tactical systems. The general then was named system program director for the advanced medium range air-to-air missile, Armament Division, Eglin Air Force Base, Fla. From August 1988 to February 1990 he served as deputy chief of staff for technology and requirements planning, Headquarters Air Force Systems Command. He assumed his present position in April 1990.

The general is a command pilot with 4,016 flying hours. His military decorations and awards include the Defense Superior Service Medal, Legion of Merit with two oak leaf clusters, Bronze Star Medal, Meritorious Service Medal with one oak leaf cluster, Air Medal, Air Force Commendation Medal with one oak leaf cluster, and Combat Readiness Medal.

He was promoted to lieutenant general April 1, 1990, with same date of rank.

General Ferguson is married to the former Mary Bird Carder of Clarksburg. They have two children, Ritson and Elizabeth.

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

Lieutenant General Ferguson and I are pleased to appear before you to review the Air Force's proposed research, development, test, and evaluation program for Fiscal Year 1991.

The world our aerospace forces must operate in is changing more rapidly than anyone could have imagined. Some examples of these changes include the apparent growing interest in the democratic form of government in Eastern Europe, Central America, and several African nations. Also, Western Europe is on the road to opening her economic markets as never before while preparing for the unification of a German nation divided for almost 45 years. All of these are examples of positive forces for change in the world community.

Even the Soviet Union is experimenting with changes. Their statements and proposals show remarkable reversals in their global view. The fact remains, however, that they have significant internal problems, not the least of which is a questionable economy. It's also a fact that Soviet strategic modernization continues while at the same time the potential for confrontation in the Pacific and Middle East has not lessened to any great extent. It is on this assessment of actual military capability that we must base our military planning, and by extension, our development and acquisition of new systems.

The United States Air Force Acquisition Program is designed to provide the systems and equipment needed by our aerospace forces to implement our national military strategy of deterrence in the most efficient manner possible. We must have a balance of military capabilities to implement this strategy. This includes the nuclear forces necessary to sustain deterrence; the conventional airpower that's essential for power projection; the airlift and tanker assets for rapid global mobility; and the space and airborne C3I systems necessary for situational awareness in a technologically advanced world.

The budget we propose for FY91 reflects the fact that the world has changed. It considers the current changes as well as those that have been occurring for several years. One pertinent change is the fact that the Air Force budget has declined 19% since FY85. Our funds for research and development have also declined (24% since our peak year of FY87) in the last several years. Additionally our portion of the FY91 federal budget request is less than 7% versus 7.5% for FY90. During this declining period, however, we've maintained a commitment to fund our Science and Technology (S&T) program at 1.5% of AF total obligation authority. We've done this because we recognize that a strong S&T program is the foundation of our future military capability. We've also focused our modernization efforts on one major system in each mission area to more efficiently use our resources.

I believe our research and development investment strategy for using those resources must be looked at independently of a specific threat by a specific adversary. It must also maximize the use of our scarce resources by providing the right mix of technology base efforts, modernization of existing systems, and development of new systems.

MAINTAINING TECHNOLOGICAL SUPERIORITY

The size of the threat to the United States and its allies may be rapidly changing, but we've seen no indications of it lessening. In fact, the quality of that threat is improving from a military perspective. For the first time in our recent history we're facing a quality versus quality confrontation as opposed to the historical quality versus quantity scenario. We believe the best way to win this confrontation is to have a strong R&D program that's designed to keep us ahead.

The primary role of our S&T program is to develop technology to serve the operational Air Force. In the past our innovative technology efforts have provided us a qualitative advantage over all our military adversaries. Many of these technological developments, however, also have civilian commercial applications. We see this as a tangible by-product that's an additional payback to the American populace.

Our Air Force-only technology development efforts are further complemented by agreements/joint programs with the Army, Navy, DARPA, DOE, and NASA. For example, the National Aerospace Plane, a key Air Force technology program, is being executed in partnership with NASA. These agreements/joint programs allow us to stretch our resource dollars and broaden our technological research. In some of these instances we've encouraged plurality of efforts because significant technical risk remains. We believe, however, that we provide sufficient oversight in these instances to prevent duplication.

MODIFYING EXISTING SYSTEMS/DEVELOPING NEW SYSTEMS

Since we consider needs and requirements in the context of mission areas, I'll address both modifications and new systems in the following categories: Strategic Modernization, Force Projection, Tactical Modernization, and Space Operations.

In Strategic Modernization our efforts to improve the survivability of our land based ICBMs feature the concept that mobility improves survivability and survivability improves stability. To complement our bombers, we continue to pursue updated conventional and nuclear weapons, including the Short Range Attack Missile II (SRAM II), the Advanced Cruise Missile, the Tacit Rainbow Defense Suppression System, and the HAVE NAP medium-range, precision guided standoff conventional missile.

In Force Projection the objective is to get a sufficient quantity of personnel and equipment to the right place at the right time. We need additional airlift capability for rapid, intertheater deployment of combat forces to support national objectives and for timely intratheater movement to meet forward area mobility requirements. The C-17 will be capable of performing the full spectrum of airlift missions and is specifically designed to effectively and efficiently operate in both the inter and intratheater environments. I might also add that it employs existing technology (i.e. FAA certified commercial engines, current civil/military avionics) to the maximum extent possible.

In Tactical Modernization we must remain capable of countering any conventional military capability in a lethal and timely manner over friendly and enemy territory. For this force, we propose to continue developing, with the Navy, the Advanced Tactical Fighter for air superiority, and the Advanced Tactical Aircraft for tactical strike. Modernization of our E-3 Airborne Warning and Control System will ensure its continued support of our tactical forces. The E-3, along with other tactical resources, plays a key role in our national anti-drug campaign.

JSTARS is a combined Air Force and Army program with both airborne and ground elements providing the "electronic high ground". This real-time targeting is essential, particularly if our defensive force is reduced and the requirement for more effective massing of force increases.

In Space Operations we will continue our efforts toward assured mission capability by improving our launch responsiveness, enhancing on-orbit capabilities, and ensuring that data products reach users in an appropriate and timely manner.

SUMMARY

We have recognized in our budget proposal that the world has changed and continues to change. Our investment strategy reflects an Air Force adapting to those changes while at the same time maintaining our ability to cope with the potential for these dramatic changes to be changed again. The quality of our RDT&E program is best measured by its support of the defense requirements of our own national policy not external events. We remain committed to a strong research and development program fully reconciled to fiscal reality.

SMALL INTERCONTINENTAL BALLISTIC MISSILE

Mr. MURTHA. Let me ask, first of all, about the Small ICBM. Last year, We took it out of the budget; the President called me, and We put it back in. I have never been a big fan of the small missile, so-called Midgetman, because I felt it was just too expensive. I have never thought that this was something that we needed.

Have you made a decision at this point what you are going to do with the Midgetman? Has a policy decision been made?

Mr. WELCH. I think all the decisions are being reviewed. Where we stand now is, we planned to put the program, as far as the missile was concerned, into full-scale development this year. Then with the 1992 budget, we would begin to pick up the basing part of that and make the basing decision.

In fact, that is what we are doing. This year, we are doing the contracting effort to take it out of the status that it was in last year, which was to prepare to complete the full-scale development on the missile. We would propose to finish up that activity contracting by the end of this fiscal year and be prepared to budget for its continuation next year.

Mr. MURTHA. Well, we see an article—that doesn't necessarily mean it is true, but it is in the "early bird" edition of April 24, "Air Force offers to cancel MX missiles on rail cars and slow down the Midgetman."

So you are telling me that that is not accurate?

Mr. WELCH. I think what you see reflected in the newspapers—and I think Secretary Cheney commented on that the other day—there are any number of options that are being looked at for the ongoing POM exercise, but as far as we are concerned, we are exercising the program that was briefed last year, both on the Rail Garrison and on the Small ICBM.

Mr. MURTHA. You are speaking for DOD. You are saying the small Midgetman, the research is going to continue and as far as you know, deployment will also continue unless we do something with it over here?

Mr. WELCH. That is correct.

I believe that last year DOD said that we were structuring a program and putting it in place to execute an operational capability in 1997.

C-17 PROGRAM

Mr. MURTHA. Well, it is certainly going to be one of the systems that is going to have a problem; no question in my mind about that.

The C-17, we have had all kinds of problems with the C-17 and software. I know the McDonnell-Douglas Company fired Honeywell, and hired GE, I believe, to overcome some problems, but the program has been delayed.

Would you give us an update on where the program is and if they are solving the software problems? Exactly what is happening and when the first airplane will be flying?

Mr. WELCH. I think there are a couple of different areas of software here. It was the flight control system where they had substituted GE for Honeywell. I think the bigger software problem that we talked about last year really was with the central computer activity that we had going, particularly with Hughes. What the Douglas Aircraft Corporation has done is effectively, completely restructure that central computer software operation. Douglas has taken over that management. We have put a—we call it a much more disciplined and phased approach to that coming on line.

If you add to that, the flight control system that is coming that was resourced to GE about this time this past year. Add to that the fact that when we talked last year we were hoping to have a flight by the end of calender year 1990 and shortly thereafter. Because of those problems, we said we were going to fly in June of 1991. That is referenced to the very original contract date which was August of 1990. So I think that consistent now with the flight date of June 1991, we are progressing very well both in the new fight control hardware and the software to support not only the central computer, but the flight control computer system very well. The integration laboratories that are necessary to support that are in place, the simulators are in place, and we are just following on what we call an inch-stone schedule. We have put down some very short increments of time so that we don't go a long period of time before knowing what the accomplishment is to be.

For about the past six months now, I think they have met each and every one of those inch-stone schedules with this new organizational approach.

Mr. **Murtha**. When I was there a year or so ago, McDonnell-Douglas was reorganizing their management team. A brigadier general was complaining that there were so many restrictions, so many decisions that had to be made in Washington that it took him forever to get anything done and the company complained about the same thing. Do we still have the problem or has that been rectified? He was complaining that an awful lot of the decisions he felt he should be able to make, he couldn't make; he had to go to Secretary Atwood.

Is that something you are familiar with and is this still a problem if you are familiar with it?

Mr. **Welch**. Sir, I think what he was referring to, there have been a large number of program reviews on the C–17 program up to the Defense Acquisition Board, which is chaired by John Betti.

I think the reviews resulted from the fact that, one, we had a very large and rapid, upfront investment in the C–17; and also because we were running into difficulties, both with the Douglas management as well as what I will call the subcontractor or supplier management. I would say the majority of that has been cleared away and we are back into a more normal cycle.

Mr. **Murtha**. If I asked him today if he was having any problems in making decisions, he would tell me that he was able to make decisions and the program is going forward on time and it will be flying in June of next year.

Mr. **Welch**. June of 1991; yes, sir.

General **Ferguson**. Just a footnote, I was talking with the Program Manager, General Butchko just yesterday and measuring progress along the inch-stones.

What we have been doing is making the major joins on the airplane, the various fuselage joins, and the tail was joined to the fuselage vertical tail day before yesterday, and that actually occurred six weeks ahead of the inch-stone schedule.

So I think everything Mr. Welch has said is certainly being verified by actual progress in the factory.

C-141 UPGRADES

Mr. MURTHA. Go back to the C-141 and tell me what the situation is. Are you doing any research and upgrade of the C-141 at all?

Mr. WELCH. If you will recall, we did a program to give a service life extension of the 141 to take it from the 30,000 hours that it was bought for and extend it to 45,000 flight hours and that was in place.

Since that time, a couple of things have happened. We are using it in a somewhat different fashion than anticipated. We are doing a lot more low-level flying in support of special operations force people, putting flight refueling in and doing it at higher loads. So we are eating those hours up at a rate faster than what we would have anticipated. So what we are seeing is some cracking in the wing box area that is going to have to be fixed and that is prior to what we would have expected at this time.

Mr. MURTHA. And that is actually restricting the weight and so forth of the airplane so you have to fly with a restricted load?

Mr. WELCH. We are flying with a restricted load so that we don't prematurely use up the flight hours. We have 20 aircraft that are actually on the ground that we are going to have to repair with that wing fix. We believe we have fixes in place that will achieve 45,000 flight hours, but we don't believe there are any more extensions left.

So in the nineties and beyond, those things will truly age out, so we need a replacement.

Mr. MURTHA. Do we need that capacity during this period? Can we afford to do without it?

Secretary Cheney said when he was meeting with us that he was going to replace plane for plane for capacity. Can we afford maybe just to put them away and let them sit until we get the new ones in or do you feel that we absolutely have to SLEP these things or do something about the cracks?

In other words, do we need the capacity?

Mr. WELCH. Yes, sir.

Secretary Cheney was talking about having 48 million miles of capability today. One third of that is potential from the civilian reserve air fleet. We have about 32 million ton miles available.

He has chosen not to expand that, but I believe that all the information has been shown to him that we need to maintain the ton miles available. He has chosen not to go beyond the current ability—our goal at one time was 66 million ton miles a day.

Mr. MURTHA. That was 10 divisions in Europe in ten days?

Mr. WELCH. Yes.

In the aircraft review, rather than looking at what might be thought of as kind of an esoteric ton miles a day, they flew in the simulator the scenarios that the JCS could expect to have to exercise and derived from that what actual lift per day per place was required.

TRANSFER OF MISSION TO GUARD AND RESERVE UNITS

Mr. **Murtha**. Is there any possibility of transferring the restricted airplanes to the Guard and Reserve only from the standpoint that they would fly less hours, or do they fly the same amount of hours per month as the regular Air Force?

Mr. **Welch**. They fly essentially the same missions so the kind of training that they require is certainly there.

So the idea was to get the funded fixes that are required for the wing into the aircraft now, restrict some of the heavy load training flights until we can get stabilized on the C-17 replacement, and maintain—and then whether they come out of the fleet on a two-for-one basis with the C-17 or whatever people are trying to work out.

But it is the combination of the Reserve component and the active force that is spoken of.

CURRENT AIRLIFT CAPACITY VS. REQUIRED CAPACITY

Mr. **Murtha**. I need to see the figures on your capacity. Figures that I can understand, for instance, using the thing we talked about before the hearing, getting them down to Panama, getting equipment there, a 22,000 or 23,000-person force with the equipment they need, say, get them to the Middle East.

That gives me a better idea of whether then we should decide we can postpone some of these repairs until we get the C-17.

I think we need airlift, but I just want to see a hypothetical or an actual situation where we would get troops there in a certain period of time and what percentage of our airlift would that be, so I will know how desperate we are here.

Mr. **Welch**. We ran the scenarios out. Perhaps we should bring the scenarios runout in the aircraft review.

We will make that available.

[**Clerk's note**.—The Air Force stated the data does not exist in the form requested by Mr. Murtha and portrayed by Mr. Welch. Additional data was not provided in time for publication.]

C-141 UPGRADES/REPAIRS

Mr. **Murtha**. I am particularly interested in whether we have to SLEP these things or whether we can save money here. I assume it would be expensive to fix these wing cracks?

Mr. **Welch**. It is expensive, but that is already budgeted and already on contract.

Mr. **Murtha**. Are you going to talk about re-engining also or just fixing the cracks?

Mr. **Welch**. No, sir.

There was a second proposal which would have extended the life of the C-141 from 45,000 to 60,000 hours. Included in that was an option to do some more extensive modifications on the fuselage and, in fact, to re-engine. If I recall that program was in the $13 billion to $15 billion category, but it has not been accepted and will not be executed.

CURRENT AIRLIFT CAPACITY

Mr. **Murtha**. I used the figures three-fourths of our airlift capacity was needed to get troops to Panama. The Secretary said he believes that includes what they were doing that day; in other words, they were running missions all over the world that day, and it was the remaining capacity.

I don't know how many of those missions could be scrubbed—probably flying dependents, et cetera—so I would be interested in the actual overall capacity.

FLIGHT RESTRICTIONS ON C-141'S

Mr. **Dicks**. On the C-141, I understand we are flying those planes now with some restrictions?

Mr. **Welch**. Yes, sir.

Mr. **Dicks**. Can you tell us about that?

Mr. **Welch**. What we are really doing is wanting to curtail the low-level flying training as much as we can and the heavy, in-flight refueling, which tends to eat up the service life at an accelerated rate.

What we are finding, there is discussion over the amplification factor, but for each hour we do a mission like that, we are probably eating up 1.7 of the available hours, is the best we can tell, and it is manifesting itself in wing cracks.

Until we can get the fixes in the airplane, Military Airlift Command is restricting the training in those segments of the mission to that absolutely necessary to maintain minimum proficiency. We need to acknowledge that we are burning those hours at a faster rate because it tells us when we have to bring a replacement in and how fast we will get to 40,000 hours. I believe the average on the fleet today is around 32,000 or 33,000 hours.

General **Ferguson**. Thirty-one thousand hours.

C-141 SERVICE LIFE

Mr. **Dicks**. How old are these planes generally? Fifteen, twenty years?

Mr. **Welch**. Twenty—they are 25, getting on to be 25 years.

General **Ferguson**. The Service Life Extension Program to fix cracks that are in the center wing and outer wing joint is really just to carry the airplane to a 45,000-hour service life. The design service life of the airplane was 30,000 hours, so the fleet is just about at that service life right now.

Mr. **Dicks**. How many years more will it take to get from 32,000, where we are today, to 45,000? What time frame do we have for the C-141? Five years, six years, ten years?

Mr. **Welch**. I think the C-17 phase-in, I think you would see this beginning to trade out by the mid-nineties, but the way the aircraft are being used, I think it will probably be 20. We will probably see the last ones around probably towards 2005 to 2010.

Mr. **Dicks**. Thank you. Thank you, Mr. Chairman.

AIRLIFT USED DURING "JUST CAUSE"

Mr. **Murtha**. Let me tell you what General Hansford Johnson said before the Committee, talking about the airlift to Panama.

He said that if we had taken what our wartime utilization rate is and what resulting capacity is, it would take 25 percent of our capacity to do what we did. If we had to move every one, including the ones on the ground, it would take 75 percent and you would have to make a second trip so that meant two trips in order to get the troops on the ground, and I assume the material also.

Mr. **Welch**. That was consistent with what we were talking about before the hearing this morning.

Mr. **Murtha**. I still am not clear and I don't know if we went into detail about whether that is the entire airlift capacity, so if you will put that in the record.

It sounds like that is what he is saying, but I am not sure I have interpreted it accurately.

[The information follows:]

In the Secretary of the Air Force's testimony, the airlift capacity percentages represented the total organic strategic airlift capability. The Secretary used, as a baseline, 100% of Air Force organic strategic airlift assets (110 C-5s, 234 C-141s) to compute the capability. No adjustments were made to the total aircraft available despite the fact that other aircraft were already committed to other high priority DoD missions, or aircraft were unflyable because they were undergoing heavy maintenance/modifications.

The representation of the organic strategic airlift required to deploy the "Just Cause" assault force, with equipment, was an effort to point out the military advantages we had during the Panama invasion. That is, Panama is in our backyard, we had a highly developed infrastructure close to our objectives, the assault force traveled light because of the existing infrastructure to support them, and half of the necessary force was already in place. It would, however, have taken almost our entire worldwide strategic organic capability had we been required to deploy a "Just Cause" sized force with their combat equipment and infrastructure, within the given time constraints of the assault operation.

Mr. **Welch**. I have talked to General Johnson on that and I believe you are interpreting that accurately.

Mr. **Murtha**. Mr. McDade.

Mr. **McDade**. Good morning. I yield to Mr. Young.

ADVANCED TACTICAL FIGHTER (ATF)

Mr. **Young**. Thank you.

Mr. Secretary, last year, the Committee expressed quite a few concerns about the Advanced Tactical Fighter development program. We were concerned about optimistic cost estimates, too much concurrency, production rates that we thought were not quite realistic, control of software, and items like that.

What program changes have you made that might address some of those concerns?

Mr. **Welch**. General Ferguson will say a few words on the specific changes, and I can add something on it. A lot of changes have been made.

General **Ferguson**. I wonder if you would like me to begin this by reviewing a little bit of the changes that were announced on the ATF by Mr. Cheney.

Mr. **Young**. That would be fine.

General **Ferguson**. As you will recall, the requirement that we defined for the ATF was 750 aircraft. We had anticipated an operational capability in 1999, and we were going to buy our first production airplane in 1994.

What the major aircraft review did was really a bottoms' up review of the requirement for the airplane beginning from basic principles to go back and determine what air superiority capabilities were really needed and look at other alternatives and what acquisition strategies might we pursue other than those which we had currently identified.

Basically, this came down to be a decision process that began with, does the threat of the projected world situation necessitate a new aircraft and what might be the required characteristics of that new aircraft considering alternatives, and then affordability and priority.

If the answer to those questions were yes, you would make a decision. There is a similar process that one could lead you through if the answers to those questions were no. I won't go into those.

The threats to our air superiority fighters for the future were fully looked at and all current Soviet aircraft, the Mig 29, Mig 31, SU-27 Flanker, aircraft like their Mainstay, the equivalent of our AWACS. This review was going on at the time threats and the perception of the threat were changing in the Soviet Union. But we concluded that, while we see the threat numbers in those various kinds of aircraft decreasing the overall technical capability of the forces that we might be asked to face worldwide are increasing.

We looked at strategy and policy guidance as well that could be forthcoming from the changed world situation. The conclusion from that was that there were no major changes, we would still seek deterrence through forward defense, presence of our forces and ability to project forces forward worldwide, early response to crises, and the capability to respond to escalation. From that, then one looked at what are the essential air superiority capabilities that we would require.

Foremost among those were the ability to have first-look, first-kill, long radius of action, survivability, and ability to penetrate enemy air space. I think this really led to a reaffirmation of the key ATF characteristics which are stealth, the super cruise capability, and advanced avionics with the key things that would allow you to accomplish all those things.

ATF AVIONICS CONFIGURATION

Mr. **Young**. While you are on the question of avionics, I understand that you have recently made a decision on the avionics configuration for ATF. Is that true?

General **Ferguson**. Yes, we have settled in on a package that we have I guess paraphrased to you in various dollar values of the avionics package. The one that has been selected is what we refer to as the $10 million avionics package.

Mr. **Young**. Can you tell us what that avionics package is going to do for the pilot flying the mission?

General **Ferguson**. Well, of course, it has the advantages of a very capable radar multi-mode capability, ability to operate in a stealthy mode which present radars do not allow us to do.

Obviously, it has avionics architecture on board that gives us much higher reliabilities than we can achieve with present-day systems. You should be able to trouble-shoot, remove and replace, have a greater degree of redundancy for crew efficient capabilities, and a greater mean-time-between-failure and replacement of the items.

It would carry advanced and very capable electronic warfare suite, and would have the modern elements of the flat panel displays and multi-mission type of displays that also have the reprogrammable capabilities, so in the event that you lose one part of your display system, you could reprogram it and bring up those things that are most critical to you.

Mr. **Young**. How much of an advancement is this over what is in the F-15? Without getting into all the technical—we are interested in the technical, but we can read that.

General **Ferguson**. It think it is really the next generation of avionics, but probably most described by the flexibility that it has to reconfigure in the event of failures and to minimize the workload on the pilot would probably be the best way to describe the pilot advantages over what kind of system you have in the F-15 system today, which is our most advanced cockpit.

Mr. **Welch**. If you go back, F-15 as we know it is 20-plus years old today as far as its architecture of its avionics system. It was what is termed kind of a flat architecture. You have a central computer and you begin to hang the various black boxes on there. This is a new generation where it is a fully integrated architecture, so whereas we have gone through several multi-stage improvement programs, we have effectively had to gut the whole airplane and take the system out and then put another in. This is the kind of architecture where with the basic system, you can change out the modules as things modernize. Our avionics systems are modernizing faster than we require the airframes or engines to modernize. It is having a continous evolution capability rather than a block upgrade.

ALTERNATIVES TO ATF

Mr. **Young**. When Secretary Cheney did his major aircraft review, did he consider any alternatives to ATF or was that ever a consideration?

General **Ferguson**. He did. The list of the alternatives were two F-15 derivatives, an air superiority version of the F-15, and another version of the F-15 which had a new wing. It used the ATF engine but had some new avionics.

Two derivatives of the F-16 and a single engine which you might describe as a single engine ATF. These really were the alternatives and trades that were made in evaluating against the mission and the threat that I described to you earlier.

Mr. **Young**. I have quite a few other questions on this subject. I would like to submit them to you in writing and have you respond in the interest of time.

ATF REPROGRAMMING REQUEST

Mr. YOUNG. Let me ask you one more. Tell us why you are planning to submit a reprogramming request for your 1990 R&D funds for ATF.

Mr. WELCH. The contracts that we had for the demonstration and validation phase in fact were not fully funded last year, and that is a commitment that we had really made to the contractor.

As you know, we did not fully fund all of the work that needed to be done during the preliminary up to full-scale development, so between fiscal year 1990 and 1991 there is an unfunded portion of that commitment.

Mr. MURTHA. What was that shortfall, $200 million?

Mr. WELCH. About 200 something million dollars. We have a reprogramming request coming up for $134 million. We were able to make some adjustments ourselves and as soon as we finish with the various other reprogrammings that you are looking at, we believe we have identified appropriate sources and we will be coming over with that.

We need to get that, as a matter of fact, rather quickly in that the contractors really would expect to be paid in the very near term and it truly is something that we owe them.

[CLERK'S NOTE.—Questions submitted by Mr. Young and answers thereto follow:]

Question. The Committee expressed many concerns last year about the Advanced Tactical Fighter (ATF) development program: optimistic cost estimates, too much concurrency, realistic production rates, control of software, etc.

What did the 6-month extension to the demonstration/validation cost and what benefits will occur as a result?

Answer. The six-month extension to the ATF demonstration/validation (DEM/VAL) program, and consequently a six-month delay to the start of ATF full-scale development program, resulted in a net fiscal year 1991 savings of $412 million. The net increase to the DEM/VAL program is $288 million. The benefits of an additional six months of DEM/VAL allows adequate time for contractors to document results from the Airborne Flying Laboratory and prototype air vehicles (PAV) as well as the ground laboratory and testing. This documentation will be submitted with each contractor bid to validate the proposed ATF design. Additionally, both contractor teams will use the time to refine Naval ATF variants to support aircraft carrier flight operations.

Question. Do you still plan to buy 750 aircraft?

Answer. In the Major Aircraft Review briefing to Congress, SECDEF maintained the option to buy 750 aircraft. However, SECDEF did comment that the total ATF buy will come under review as force structure decision evolve during the budget process.

Question. Please tell us in both constant and real dollars the ATF costs, total development cost, total production cost, total program cost, and projected aircraft unit cost.

Answer. The numbers shown below are base year 1985 dollars followed by FY 1990 dollars in parentheses;

Total development cost: $11.9 billion ($14.1 billion).

Total Production cost: $41.9 billion ($49.4 billion).

Total program cost: $53.8 billion ($63.5 billion).

Projected aircraft unit cost: $43.5 million ($51.3 million).

Question. What is the latest "Initial Operating Capability (IOC)" estimate, and how does this compare to your original estimate?

Answer. The Air Force has not established an IOC date for the ATF. However, the Major Aircraft Review did delay production by two years, decreased the maximum production rate from 72 aircraft per year to 48, and lowered the initial production ramp. The result of these changes delayed the first operational squadron by three years. Our current schedule estimates the first operational squadron will be in 2002.

[CLERK'S NOTE.—End of questions submitted by Mr. Young.]

Mr. MURTHA. The time of the gentleman has expired.

Mr. Dicks.

DOWNSELECT OF ATF CONFIGURATION

Mr. DICKS. One of the things the contractors have said to me is whatever you do, let's have a down select, choose somebody. Are you going to do that?

Mr. WELCH. Yes, sir.

Mr. DICKS. When will that decision be made?

Mr. WELCH. The decision is scheduled to be made at the end of April 1991 and the contract to be awarded about two months thereafter. Consistent with Secretary Cheney's decision, as we understand he made last week, that would occur on time.

NEED FOR FSD IN FISCAL YEAR 1991

Mr. DICKS. Explain why you think it is wise to begin full-scale development for $283 million in fiscal year 1991, or is that still your plan?

Mr. WELCH. In the budget that is over here right now, it is consistent with making those awards.

Mr. DICKS. Are you going to adjust that because of Secretary Cheney's decisions?

Mr. WELCH. No.

ALTERNATIVES TO ATF

Mr. DICKS. What about alternatives to ATF? What were the alternatives including the F-15 XX?

Mr. WELCH. General Ferguson spoke to the F-15 XX. We can go into a bit more detail.

General FERGUSON. That was the new wing and use of the ATF engine and some improved avionics.

Mr. DICKS. You don't think that is a very attractive alternative because it is not stealthy or not stealthy enough?

General FERGUSON. It was a survivability aspect of that particular airframe that causes it not to be a winner, that is correct.

Mr. DICKS. Were there any real dramatic cost savings by using alternatives, like the F-15 or F-16?

Mr. WELCH. The alternatives that were looked at were very close to being new airplanes. There was not a big cost discriminator. The biggest discriminator was the fact that they just didn't meet the requirements.

RAIL GARRISON MX

Mr. **Dicks**. The fiscal year 1991 budget request includes $548 million in R&D and $2 billion in procurement for the rail mobile MX missile. What is the status of the MX Rail Garrison development program?

General **Ferguson**. We began testing in 1987. We think the test results that we have had to date do prove the fact that to go to the rail garrison mode is a low risk and therefore a high probability of success program. We have conducted a number of sled tests, all of which have been successful, and we do those tests in order to be able to evaluate the guidance. Testing has indicated that, in fact, the guidance system will meet program requirements as we put the MX Peacekeeper on a mobile platform. We have had the first shot of our cannister and launcher test program. That was in July and was successful. We plan our second shot in August, so we think test results to date are successful and prove that we can put Peacekeeper into the Rail Garrison mobile mode.

MX RAIL GARRISON CANCELLATION PLANS

Mr. **Dicks**. During the recent Major Aircraft Review, and I suspect as you were deliberating the new POM, there were stories that the Air Force proposed to cancel plans to deploy the MX Rail Garrison and use the savings to fund shortfalls in other systems like the bomber.

Is any of that accurate?

General **Ferguson**. I think Mr. Welch really provided the answer that applies also to rail garrison with the small missile. The only thing I would like to add is there really were no trades like this that took place during the Major Aircraft Review. That study was strictly associated with the programs in question.

Mr. **Dicks**. So instead of trying to save something else, the Air Force was ready to throw in the towel on Rail Garrison MX, right?

Mr. **Welch**. No, sir. The article was inaccurate in the sense it was perhaps addressed to all the various options being looked at in the out years. Our present plan and the only direction we have now is to continue the Peacekeeper Rail Garrison on the schedule it has been reported to you and on the Small ICBM. This is the time of year where you could find an option for anything.

Mr. **Dicks**. Is cancellation under consideration in the POM?

Mr. **Welch**. I am not aware it is under consideration.

Mr. **Dicks**. Wouldn't you be aware if there was an effort to cancel?

Mr. **Welch**. I would hope so.

RAIL GARRISON STRATEGY

Mr. **Dicks**. Is the strategy to be able to operate out of garrison by maintaining continuous movement on the railroad network, or by deploying the missiles to satellite bases?

Mr. WELCH. I think the concept has never really changed. It is deployed at Minuteman sites and in the first place it will stay in garrison and it will deploy at the call of the President really.

As you go to increasing stages of alert, it is the same way that you might generate the bomber force. It can be fired from garrison, but it is not meant to be out wandering around.

Mr. DICKS. Not all the sites are rail sites. Fairchild Air Force Base, in Spokane, is a SAC bomber but not a Minuteman base——

Mr. WELCH. I am sorry, they are on SAC bases. Excuse me.

MX PROGRAM SCHEDULE

Mr. DICKS. It sounds like the program is in trouble. Due to the fiscal year congressional reduction of $150 million, the DAB III milestone has slipped. What is the current schedule?

General FERGUSON. The DAB III milestone is now scheduled for February 1991 and that is a slip from April of 1990. We are still looking for a full operational capability in December 1994. From previous reports, that is a six-month slip.

MX RAIL GARRISON FUNDING LEVELS

Mr. DICKS. How much has been spent to date on MX rail garrison through fiscal year 1990 in both procurement and R&D? How much more is needed to complete this program?

General FERGUSON. Well, to date it is about $1.3 billion.

Mr. DICKS. Do you know the breakout between the two, procurement and R&D?

General FERGUSON. That is all RDT&E.

Mr. DICKS. No procurement money has been spent up to this point?

General FERGUSON. No, sir.

Mr. DICKS. How much more is needed to complete this program?

General FERGUSON. About $517 million, which is in 1990 and then in the out years, 1991 and beyond, about $5.2 billion, for a total of about $5.8 billion.

Mr. DICKS. $5.8 billion——

General FERGUSON. Which includes RDT&E, procurement and Military Construction.

Mr. DICKS. Is that funding basically 1991 and 1992 and then the program would be finished? Do you recall?

Mr. WELCH. No, the procurement, as you know, is limited to 12 missiles per year. I believe it takes out to 1996 to get all the necessary missiles. I believe there is a total of 173 required in the program.

SMALL ICBM

Mr. DICKS. Let's go back to the Small ICBM missile for a second. Have you made a decision on the eventual size of the Small ICBM force?

Mr. WELCH. No, sir.

Mr. DICKS. Is the configuration of the final reentry vehicle known at this time?

Mr. WELCH. The reentry vehicle itself, there has been a question with respect to one or two RVs.

Mr. **Dicks**. Yes.

Mr. **Welch**. No. We are basically designing a one-RV missile. We have the option through fiscal year 1991, really through this year, to make that decision and it has not been made. So that option remains.

Mr. **Dicks**. Is the Five-Year Defense Plan accompanying the fiscal year 1991 budget fully funded to achieve this IOC, 1997?

Mr. **Welch**. The Five Year Defense Plan, FYDP, program that was updated and presented by Secretary Cheney over here I believe is funded to in fact get to IOC in 1997. I will have to check that, though.

[The information follows:]

The Five Year Defense Plan (FYDP) supports the baseline Small ICBM program which includes 500 single reentry vehicle (RV) missiles deployed on Hard Mobile Launchers at Minuteman bases with a 1997 FAD/IOC. The 2-RV missile and Southwest basing options will be maintained until fiscal year 1992 when a Presidential decision is required. If the RV and basing decisions are delayed beyond 30 September 1992 additional funding will be required. Further, if a decision is made to pursue either the 2-RVs or Southwest basing additional funding would be required to support the new program requirements.

BASING LOCATION DECISION

Mr. **Dicks**. Has a basing location, northern versus southwest, been decided? I assume that is no.

Mr. **Welch**. That is no, but as a general statement, if you go—you don't have an option of going south if you went to two missiles, so that is one point to it. We maintained that option, but the general plan has been one warhead in the northern bases.

NEW GUIDANCE SYSTEM FOR THE SMALL ICBM

Mr. **Dicks**. Has the Air Force done any analysis on the possibility of introducing a new guidance system for the Small ICBM? If so, what are the results of this analysis?

Mr. **Welch**. There has been a continuing study. The most recent one was last fall.

On a 1997 IOC, there would be no time available to introduce a new one. If the IOC were to come later, more like the year zero zero, we would have the opportunity to do that and those studies are done under the ASMS program.

Mr. **Murtha**. Mr. McDade.

EFFECT OF THE MAJOR AIRCRAFT REVIEW (MAR) ON R&D

Mr. **McDade**. Thank you.

We have had the MAR completed, what is the net effect of these changes on the fiscal year 1991 R&D budget? Do it program by program if you want to.

Mr. **Welch**. As we have looked at—I don't have a detailed breakdown by each account number, but in fiscal year 1991 on the A-12 program, as we understand it, there is no impact. On the ATA, no impact. In ATF, there is no impact. In the B-2, there would be a reduction of $1.37 billion. On the C-17, there would be a reduction of $1.04 billion for a total impact in fiscal year 1991 of $2.41 billion.

Mr. **McDade**. That is procurement money you are including in there, isn't it?

Mr. **Welch**. Yes, sir.

Mr. **McDade**. I am only asking about the R&D side.

Mr. **Welch**. My understanding is there is no impact on the R&D side.

[**Clerk's note**.—During a July 13, 1990 briefing from the Air Force, the Committee learned that indeed the fiscal year 1991 B-2 RDT&E requirements have increased. The new estimate is $1.751 billion, an increase of $184 million over the fiscal year 1991 request of $1.567 billion.]

CHANGES TO ATF UNIT COST

Mr. **McDade**. Based on the changes to the ATF program, do you anticipate the unit cost is now going to exceed $35 million?

Mr. **Welch**. Yes, sir.

Mr. **McDade**. What do you project the unit cost to be now?

Mr. **Welch**. We are trying to get the details of that number now. When we were over here last time, we were saying that it was probably up in the $37, $38 million kind of range. With the stretch-out of the full-scale development of a couple of years and the change in ramp so that we only go to $48 million instead of $72 million, I would guess that it would be in the low $40s now, but I do not have an exact number.

Mr. **McDade**. That figure I think that you expressed was constant dollars—what is it in real dollars, a ballpark figure?

General **Ferguson**. The number that corresponds to the $37 million in then-year dollars is $67.6 million.

Mr. **McDade**. That corresponds to the $37 million and we are now into $40 million? What is the figure that is consistent with that one?

General **Ferguson**. In fiscal year 1990 dollars, it is $47.9 million unit flyaway cost, as we have presented it in the 1991 budget.

Mr. **McDade**. Unit flyaway cost?

General **Ferguson**. Yes.

B-2 UNIT COST CHANGES

Mr. **McDade**. We also have a different pricing on the B-2 because of the stretchouts. What do you estimate the unit cost of that aircraft in 1990 dollars?

Mr. **Welch**. The program that Secretary Cheney talked about the other day, which has a total cost of $61.1 billion, the flyaway cost in then-year dollars was about $550 million.

Mr. **McDade**. What is the unit cost in 1991 dollars under the new program?

Mr. **Welch**. I have got it in base year and I have got it in then year dollars. I will have to get that.

[The information follows:]

The B-2 System Program Office currently computes flyaway cost of a 75 B-2 aircraft buy, using the OSD Major Aircraft Review profile, in FY 1971 dollars, as being approximately $43 million.

STATUS OF THE B-2 DEVELOPMENT PROGRAM

Mr. **McDade**. Let's concentate on the B-2. As you know, you are requesting $1.6 billion to continue the development and testing of the B–2. Describe for us, Mr. Secretary, the status of the B–2 development program.

Mr. **Welch**. The B–2 development program has been moving along.

Mr. **Murtha**. If you would, put it in the record because we are going to have to make some tough decisions this year. Give us figures for what was the buy going to be in the ATF down the road.

[The information follows:]

The development program has been progressing well. The successes we have seen in the flight test program are indicative of the health of the development program. To date, air vehicle #1 has flown twelve times accumulating a total of 55.6 hours flying time. Achievements include routine aerial refuelings, engine airstarts, maximum speed of more than 350 knots, maximum altitude of 35,000 feet, and flight envelope expansion to allow for the start of low observable testing. Throughout this initial flight test, the aircraft itself has proved to be a sound performer. Minimal maintenance actions are required following a flight and the maturity of the production program is embodied by the absence of any fuel leaks. Finally, the close correlation between simulator data and actual flight test results increases our belief that there will be no major surprises uncovered in the test program.

TOTAL B–2 PURCHASE

Mr. **Welch**. Seven-hundred and fifty aircraft. That did not change with the recent MAR decision, but the rate at which we would purchase them did. As we previously had talked to you, we were going to ramp up to 72 per year and the numbers most recently that came out of the MAR were 48 per year.

Mr. **Murtha**. This is delayed for two years, is that right?

Mr. **Welch**. Yes, sir.

Mr. **Murtha**. Okay. Thank you.

STATUS OF THE B–2 DEVELOPMENT PROGRAM

Mr. **McDade**. The question was, describe the status of the B–2 development program.

Mr. **Welch**. The development program is really going quite well. We are back in flight status. We flew last Friday and if we are on schedule, we are in the air right now flying this morning.

I think it is interesting this is the first all-Air Force crew that is flying and the first of the operational test pilots, OT&E pilots are flying. So we have in this block of flight tests the need to finish all of our envelope expansion and to do the necessary auto pilot work to get ready for low observability testing, which is a precursor to being able to award the fiscal year 1990 procurement funding.

Mr. **McDade**. When is that scheduled?

Mr. **Welch**. For September.

Mr. **McDade**. Do this, walk us through the tests that you have had to date and tell us what the results have been as you have gone through each one of these tests, the flight tests.

Mr. **Welch**. I don't know that I can give them to you one at a time, but let me try to summarize.

They are basically for envelope expansion and for finishing all the confidence measures that we can fly and that part of the envelope we need to do to do the low observability testing. To date, up to last Friday, we have had 37.8 hours. The aerodynamic stability is better than expected. The drag is within 5 percent of prediction. Pilot reports say it is smooth and precise.

We have had many contacts with a KC-10 in several in-flight refuelings. I think the best overall look is the last flight which was six hours and five minutes so we are really building up flight time. I think the planned flight today is over six hours. If we go into the detail of each flight as far as flight data is concerned, we are seeing a remarkably clean airplane that flies just like the simulator.

We have a few anomalies; being a tailless airplane it has drag rudders on the end. The trim on those drag rudders is a little bit—the trim required, how much deflection is required, seems to be a bit more than anticipated.

On a normal airplane, that wouldn't be a problem, but since we have to keep the surfaces trimmed for the low observability, we need to do tuning on the auto pilot. We have had a Defense Science Review Board review of the first block of test results. Everybody is confident that we are on schedule.

LOW OBSERVABILITY TESTS

Mr. McDade. Describe the low observability test you are going to run in September which you said is the last one prior to——

Mr. Welch. Fiscal year 1990 funds are restricted until we begin the testing.

Mr. McDade. You intend to begin in September?

Mr. Welch. Yes.

Mr. McDade. When are they expected to finish?

Mr. Welch. We should have a report by December.

Mr. McDade. Describe what you are going to walk through when you come to September—December?

Mr. Welch. It will be flying the airplane on a range that will in fact make detailed measurements. I am not sure I can go into too much detail as this particular level, but they are essentially signature measurements.

Mr. McDade. What is the range you are going to use to test this?

Mr. Welch. Again, I don't think we can handle that in here, sir.

Mr. McDade. What about the types or radars you are going to fly it against?

Mr. Welch. They would be measurement quality radars.

Mr. McDade. In the various frequency ranges that represent the threat to Soviet structure, the Soviet architecture, is that what you are going to fly against?

Mr. Welch. Yes, sir. These are surrogates that allow us to make more precision measurements. They are not operational testing; they are engineering measurements rather than operational type.

[Clerk's note.—Subsequent to the hearing Mr. Welch revised his remarks to read as follows:]

No, sir. These radars do not represent any operational radars but rather allow for precise engineering requirements. They are not operational testing; they are engineering measurements rather than operational type.

Mr. McDade. Describe that.

Mr. Welch. Accuracy——

Mr. McDade. You want to see whether or not the airplane lives up to its billing against the Soviet threat?

Mr. Welch. To make sure it lives up to the specification that we have developed for flight test which was derived from the threat.

Mr. **McDade**. Ground to air, air to air—what is the mix?

Mr. **Welch**. That's not relevant for this phase of testing. We're performing engineering tests to determine to overall vehicle signature.

Mr. **McDade**. All ground-to-air threats?

Mr. **Welch**. No, sir. The instrumentation is on the ground, but it may represent in fact measurements that can be extrapolated that would have included the cross-section measurements at the frequencies represented by airborne threats.

Mr. **McDade**. What are you going to do about the look-down/shoot-down capability that we are told the fighters have? Is that going to be in this testing?

Mr. **Welch**. I will have to look at the frequencies. It is in the test measurement set up but whether that actually occurs during this series, I don't know.

FISCAL YEAR 1991 TESTING PROGRAM

Mr. **McDade**. What tests are you planning during the next year? What do you hope to accomplish in the next year?

Mr. **Welch**. What I would like to refer you to is the maturation matrix available to the staff that tells for each calendar year each series of tests that we need to do before we make the following year. It gets more and more sophisticated with respect to the number of tests against the different frequencies and the different potential threat surrogates. But it is a very detailed——

Mr. **McDade**. I am trying to get a handle on what you are going to do next year in your testing program. What are you going to test against and what do you hope to demonstrate? That is what I want described.

Mr. **Welch**. What we are testing against is really an instrumentation system that can measure and derive measurements of the radar cross-section at several different frequencies.

We are going to fly at different altitudes and different attitudes, and it is a very long series to make measurements all the way around the aircraft so we can construct the kind of signature diagams that you have seen before to see if, in fact, we are achieving the low observability and not just in radar.

The total low observability spectrum that we have called for in the specification.

Mr. **McDade**. Do you expect that to be what you will be doing the entire year?

Mr. **Welch**. Yes, sir. There are three plus years and they get increasingly sophisticated. You begin to get the operational testers involved in this process and in fact there is also the testing that is involved in the emitter locator system which gives people the situation awareness aboard to also do evasion as well as the ability to suppress your radar cross-section.

General **Ferguson**. In a very general description of testing, the low observables as Mr. Welch has said will begin this year and will continue through and into 1994. We would expect to begin some radar navigation testing of the avionics on board the airplane in 1991. That would continue for two years.

We will begin to do avoidance work in 1991 and that continues for one year. Weapons separation testing begins in 1991 and weapons accuracy testing begins in 1992.

Mr. **Murtha**. If you have any questions on B-2, we will take a little extra time on this because this program in my estimation is a critical program. We have to know something about it.

There is going to be a real push to eliminate it on the floor, so we have to know everything we can about it, including the cost for less and more.

Mr. McDade can continue, but if you have any questions, he will yield.

Mr. **McDade**. Finish the description, General.

General **Ferguson**. That is the overlay of the type testing. One of the most encouraging things is how well the airplane is performing against our simulations that we have had as far as flying qualities.

On the last flight we took the airplane to 35,000 feet and .8 Mach, which were the test card points that we wanted to get to and pilots continued to give very good reports about how honest the airplane is.

FISCAL YEAR 1991 RESEARCH AND DEVELOPMENT PROGRAM

Mr. **McDade**. Describe precisely how the fiscal year 1991 R&D money is going to be used. Break it down in blocks and tell us what you are going to do with it.

Mr. **Welch**. The fiscal year 1990——

Mr. **McDade**. 1991, the $1.6 billion that is in this budget.

Mr. **Welch**. The RDT&E money is about one half of that along with the airframe and that is the full-scale development.

The avionics part is about $2.6 million. The weapons delivery system, $8.1 million. About $85.1 million goes into flight test. About $46.4 million into ground test. The support system development is about $675 million of those costs. And then, of course, we deliver next year air vehicle No. 3, which is the full avionics vehicle. It has all of the equipment in it.

We continue to assembly of the last three test vehicles. We have already mentioned that we are continuing the radar cross-section and low observability testing, the inertial navigation accuracy and coherent radar work in a C-135 flying test bed, and the durability and static testing that is going on with two other airframes. We would also complete the first life of the durability test program and start into the second life.

We would begin to work with the data and the training and the test systems that will come into place to support the program as it moves towards an operator.

Mr. **McDade**. Mr. Secretary, in past years if history was a lesson to us, it was that the R&D side of the house was understated and you reprogrammed in. Is that a accurately priced budget? Are we going to look at that as really what the requirements are?

Mr. **Welch**. It was a truly priced budget. Secretary Cheney modified the procurement program and we have to reassess that. But the Amended President's Budget that you have was priced such that we would not have to move funds between the two but I have to wait until we are able to assess the Cheney profile that was made.

IMPACT OF THE MAJOR AIRCRAFT REVIEW ON B-2 RDT&E

Mr. **McDade**. The Major Aircraft Review takes us from five airplanes down to two?

Mr. **Welch**. Yes, sir.

Mr. **McDade**. Tell us how that impacts on your side of the house on the R&D budget.

Mr. **Welch**. As far as the R&D budget is concerned, they made no impact but in terms of aircraft availability, that changes the various overhead rates and other things at the contractor and how that will roll back into the R&D costs.

Mr. **McDade**. You are saying that as the slowdown occurs, there will be different pricing systems upward bound, of course, as this thing gets stretched out and that will come over into the R&D budget as well?

Mr. **Welch**. They may be into different contracts. I would think of it as a zero-sum game at this time.

Mr. **McDade**. Do you expect the budget to increase or decrease under the new plan?

Mr. **Welch**. I hope it will stay the same, but we have to look at overhead rates and others.

Mr. **McDade**. When do you expect to be finished?

Mr. **Welch**. We anticipate no significant change to the RDT&E budget in fiscal year 1991.

CONTRACTOR PERFORMANCE ON B-2 DEVELOPMENT CONTRACT

Mr. **McDade**. What is the contractor's performance on the B-2 development contract, in terms of the original contract target value?

General **Ferguson**. Well, as a beginning, just to remind you, a full-scale development contract is cost-plus-incentive fee and the initial contract target price, and this in then-year dollars, is $9.4 billion, and the current contract price once again in then-year dollars, is estimated to be $10.1 billion with an estimated price at completion once again in then-year dollars at $16.1 billion.

Now the way in which one can incentivize the contractor against overruns, on a program such as this, with an incentive fee contract diminish significantly. However, an overrun status is reflected in past performance, would impact potential for future business, and would gain his attention to control costs.

Mr. **McDade**. Is that the only way to incentivize the contract, to ratchet the prices down?

General **Ferguson**. We are using methods in order to be able to do that. For instance, we just completed an overhead review with the contractor which led to some negotiated savings on the order of about, we think, $1.5 billion.

And we are also negotiating potential changes that will allow us to reduce costs through initiatives such as our industrial modernization program looking at specifically high-cost components that can be redesigned for better producibility and also perhaps at reincentivizing the contractor through the award fee which is available on the contract.

The program manager has $129 million that could be used to incentivize the contractor to improve his cost performance and we are looking at ways that we might use that kind of incentive fee. We have not paid an incentive fee for this contract for over four years.

PROGRESS ON B-2 FLIGHT TESTS

Mr. McDade. And the B-2 flight tests being conducted at the pace envisioned by the Air Force's original RFP and the contractor's response to it? If the answer to that is no, how far off are we and what are the implications on development costs?

Mr. Welch. I think that the original program was reevaluated as part of an early risk assessment and I think there have been several different groups that have looked at this now.

There was an Air Force Systems Command Blue Ribbon group and the Defense Science Board and the Rand Corporation looked at the front end. When we tried to take concurrency and add test into the program, we increased flight test aircraft from four to eight and the number of average flight hours per month were reduced from 40 to 20, so we could get a more sound schedule, and the flight test months were increased from 134 to 176 flight test months for a 3600-hour test program.

So there have been significant additions made to the test program to answer a number of questions. That is best captured in the system maturity matrix which we have sent to you.

We believe that the current estimate on the B-2 total development costs in then-year dollars will be $21.6 billion and I think General Ferguson gave you a track of where those numbers started.

Mr. McDade. Provide for the record a detailed funding breakout in each fiscal year 1989-1991 compared to the target contract.

[Clerk's note.—The answer was provided for the Committee's files.]

Mr. McDade. What is your current estimate of the B-2 total development cost in real (then-year) dollars?

Mr. Welch. The current estimate of the total B-2 development cost in real (then-year) dollars is $21.1 billion.

IMPACT OF AIRCRAFT REVIEW ON B-2 SCHEDULE

Mr. McDade. Tell us, is it a fair statement that the Secretary's decision to push this program out a little further in terms of production time enables you to do a lot more R&D? In other words, to get a lot more sophisticated testing before you actually get into a large procurement program?

Mr. Welch. Yes, sir. I think the test program that is involved in the program that Secretary Cheney talked about the other day is in fact the same test program, but it does decrease the number of production aircraft that are on order before that test program is complete. So it doesn't change the size.

I think it gives us a bit more time and will give us a higher confidence in accomplishing that.

Mr. McDade. It eliminates concurrency of the program to a large extent?

Mr. Welch. It eliminates more. We would never get 100 percent nonconcurrency.

COST OF B-2 TERMINATION

Mr. McDade. What are the total sunk costs in the B-2 program?

Mr. Welch. The sunk costs through fiscal year 1990, about $26.2 billion, I believe.

Mr. McDade. Twenty-six billion dollars?

Mr. Welch. Yes, sir.

Mr. McDade. Let's assume that the Kasich amendment should succeed and zero out this program. What would be the costs?

I want to get the costs associated with zeroing the program but I want to have it in terms of contract terminations, how much to shut down the line, et cetera.

Suppose that the leading amendment is, as you know, Congressman Kasich to zero the program. There is $26 billion in the program already. Tell us what the implications are in case the Kasich amendment passes.

Mr. Welch. The number will be in excess of the $26.1 billion by the time we pay off—there is a lot of indemnification in this program I think that people forget. The contractors had to facilitize to both special facilities as well as large size facilities for a program of this type. So there are capital investment indemnifications that would have to be recognized because most of those were planned to be amortized over probably 70 airplanes. It would be in excess of the $26 billion, I believe.

[The information follows:]

The Kasich amendment proposes to stop B-2 production at 15 aircraft. This will make the total costs $35.4 billion, and will not give us any combat capability. Just about half of the total cost for 75 aircraft has already been invested; that's sunk cost and amounts to about $26.4 billion through fiscal year 1990 (excluding military construction of $.3 billion). For $34.7 billion, which is the cost to go, we can put 60 combat aircraft in the hands of the operator. We have already invested nearly half of the total program costs, and stopping the program as Mr. Kasich suggests will drive up the 15 aircraft we have appropriated money for to a unit acquisition cost of $2.36 billion per copy. Now, the average incremental cost of the next 60 aircraft is $450 million each in Then Year dollars. The B-2 program cost will amount to about 1.1% of the total DoD budget over the procurement years of the B-2 program. That compares very favorably to the B-52 which accounted for 1.4% of the DoD budget and the B-1 which accounted for 1.6% during their procurement years. Stopping the B-2 with just 15 aircraft means we will get essentially no increase in our combat capability for the money we've invested.

Kasich amendment: No additional production aircraft authorized after fiscal year 1990 (15 total aircraft), complete, full scale development.

The estimated program cost will be $35.4 billion for 15 operational aircraft ($26.4 billion sunk cost, excluding MILCON, through fiscal year 1990 assuming fiscal year 1991 amended President's budget). The costs to go includes the cost of completing the text program ($5.1 billion), and all costs associated with curtailment of production activity ($3.6 billion). Curtailment cost includes the cost of closing facilities, disposition of tools and fixtures, severance of the workforce, compensation to contractors for unfulfilled amortization of capital investments in plant and equipment, and disposition of specialized parts and materials in inventory or on noncancellable order. Overhead burden charges on the existing contracts would increase due to allocation of fixed expenses over a smaller business base. The unit cost of 15 operational aircraft turns out to be $2.36 billion each.

Decisions being made today will determine our nuclear warfighting capability for the next 30 years. ———. This sufficiency provides the needed damage expectancy against targets identified in the current SIOP. Diverse employment differences between penetrating and standoff cruise missile bombers prevents the Soviets from countering both with any single defensive measure or technology breakthrough. A capable penetrating bomber leg is critical to the diversity, balance and continued viability of the TRIAD.

If the B-2 is not procured, the bomber leg of the TRIAD will atrophy. In a START environment the B-2 may carry up to ——— of all accountable warheads. Overall, bombers carry roughly ——— of the total actual warheads while counting only ——— of accountable warheads.

Looking at the situation in terms of a potential START II, the B-2 accounts for ——— of alert weapons. There will be ——— total force weapons on alert. In a delayed response scenario, TRIAD alert forces provide ——— arriving warheads. With a ——— alert rate the B-2 ——— contributes ——— arriving warheads or of the total arriving warheads.

If the B-2 was terminated, there would be only ——— warheads. Only ——— of alert weapons would be on bombers. In a delayed response scenario, TRIAD alert forces provide ——— arriving warheads and of these only ——— are bombers. The bottom line is that without the B-2, there is a ——— reduction in arriving weapons.

Mr. McDade. We need to get the very hard number because a lot of our colleagues, I think, don't know that this was first-time tooling, first-time production models and the contract provides, does it, that the contractor would be indemnified?

Mr. Welch. Yes, sir, and his subcontractors, also.

Mr. McDade. We need to hear the impact—there is something like 160 people on that Kasich bill that are co-sponsors. We need to have a detailed answer—why don't you ask the Secretary to send over to the Committee—with the permission of the Chairman, we will make part of the record the implications of the cost analysis, and at some point we need to get the implications, as well, from the standpoint of the strategic posture of the nation.

The decision not to count bombers in the upcoming START agreement, it always was considered to be an enormous advantage to this country; is that right?

Mr. Welch. The counting rules very strongly favor the bomber. More importantly than that, as the number of available warheads decreases, that begs an even more powerful measure.

Mr. McDade. I would also like the Department's analysis of the impacts on the security of the country should the Kasich amendment pass and the program be zeroed.

Mr. Chairman, I would like that to be made part of the record.

[The information follows:]

Decisions made today will determine our nuclear war-fighting capability for the next 30 years. Our deterrent strategy requires a mix of modernized, capable penetrating bombers and standoff cruise missile carrying bombers. The employment differences between penetrating and standoff cruise missile bombers prevents the Soviets, or other potential adversaries, from countering both with any single defensive measure/technological breakthrough. If B-2 is not procured, the bomber leg of TRIAD will atrophy. ———. We will put our nation's security at an unacceptable level of risk if we do not buy the B-2 as our penetrating bomber. By 2000, B-2 will be the only bomber capable of penetrating and attacking the most heavily defended Soviet targets. ———. The bottom line impact of the Kasich amendment is that our deterrent capability is greatly reduced and we place the nation at, what we consider, an unacceptable risk.

Mr. Murtha. Any other questions on the B-2?

Mr. Dicks.

SIMULATED LOW OBSERVABLE ASPECTS OF THE B-2

Mr. DICKS. I don't know whether we can get into this at this classification. As I understand it, when we talk about the simulations in terms of night characteristics, as I understand it, there were also simulations done about the stealthiness of the B-2; is that correct?

Mr. WELCH. Yes, sir.

Mr. DICKS. Can we talk about this?

Mr. WELCH. Generally.

Mr. DICKS. In general terms. We did similar simulations on the F-117, as I understand it. When they actually flew against the radars, it was very close to what had been simulated, isn't that correct?

Mr. WELCH. That is correct.

Mr. DICKS. It would, therefore, give us some confidence that because the simulations here are also so very good in terms of stealthiness characteristics, that more than likely we would find the same thing as we get into this testing program, is that not probable?

AFT DECK CRACKS ON THE B-2

One of the major issues is going to be, is this thing stealthy or not, can it be tracked, et cetera. Many of us here have sat through a lot of hearings on the B-1 and we didn't hear from the Air Force—part of the problem here candidly is the Air Force's credibility has been damaged because of what happened on the B-1. I didn't hear anybody mentioning cracks. We have been told that there has been a crack problem on the B-2. Can you tell us about that, and where we are and any other problems that we have had thus far.

I don't think this Committee wants to go through what we did on the B-1. We were told everything is wonderful, then we get down and we have got leaky wings, all the other problems associated with the B-1, we were never told about.

Do we have any problems of significance with the B-2?

Mr. WELCH. I don't think we can answer your correlation question with test data at this level, but there is data available on prior programs testing in-flight measurement and we can get a package together, come over and selectively talk about that if the Committee wishes.

Secondly, the crack situation is, as you come out of the engine exhaust, there is a large super-plastic form plate. It is a rather thick titanium plate and it is a compound curvature. March 30, this year, and I think it has been reported, we found some surface cracks, short ones in the surface. On doing some additional investigation, I believe the number of cracks is about six that we found on the number one airplane. We have put together as good a group of experts as we can to try to find out what is causing those cracks. The only thing we know so far is that it has got to be some stresses that we did not predict at that point. I think it will be probably the second half of May before we are able to get in and find out. Now, what we have done in the meantime is essentially cut those out and put a plate over them of the same titanium material and it does not impact ability to flight test nor safety of flight, but we certainly need to have that cured.

Mr. DICKS. It doesn't have any effect on the stealthiness of the airplane because it is behind the engine.

Mr. WELCH. It does if you had to put patches on. You create edges when you put a patch on top. So, yes, it does, and we are confident that we will be able to fix that.

At the moment, I have to tell you it is the first of the things that we found that we don't have a complete answer to. We know metallurgically that the aft deck is okay.

Mr. DICKS. Who produces that piece?

Mr. WELCH. It is a subcontractor of LTV. I think it is the world's biggest press that turns the plastic form out. I can get the name for the record.

[The information follows:]

The cracks occurred in the aft deck behind the engines. This section of the aircraft is manufactured by LTV in Dallas/Ft. Worth. The aft deck itself is manufactured by LTV.

General FERGUSON. Sometimes, when we communicate, we don't communicate. When Mr. Welch mentioned that in one of the early test flights, we noted an out-of-trim condition where our trim tabs were running slightly more divergent from the streamline on the wing, that is a concern to us. That could affect the measurements of that radar cross-section of the airplane.

We are trying to communicate to you problems as we see them a they come along.

Mr. WELCH. As you know, we have been through the problem of mixing up the fasteners. Where there are shear intention fasteners that have the same kinds of end nuts, we have had to do some punching, not a safety of flight item, as far as structural integrity, but something that costs time and this occurrred at all the major contractors, Boeing and LTV and Northrop. The good news is we have not seen any leaks like we saw in the B-1 program to date. But we are using a different sealing.

IMPACT OF B-2 TERMINATION

Mr. DICKS. What would you do if they cut this program off at 15 or 16 aircraft? Would there be any utility to those planes?

Mr. WELCH. I don't think that an operational commander——

Mr. DICKS. One unit, one wing?

Mr. WELCH. One wing is 30 airplanes, but that is 30 airplanes PAA. You still need back-up, test airplanes, training, so you can't just go with that number. Typically, the number that Secretary Cheney talked about was 75 airplanes.

That is two squadrons of 30 each. You need 75.

Mr. DICKS. Fifteen for training purposes?

Mr. WELCH. Training, test, depot.

Mr. DICKS. Mr. AuCoin.

ASAT BATTLE MANAGEMENT SYSTEM

Mr. AUCOIN. I thank the gentleman for yielding.

I want to switch to the ASAT Battle Management System, and I have a series of questions that I want to have you respond to for the record.

I would like to ask these because I would like to have a discussion on it, but unfortunately, under the time constraints we are operating under today, Mr. Welch, I am not going to be able to do that.

[CLERK'S NOTE.—Questions submitted by Mr. AuCoin and the answers thereto follow:]

Question. The fiscal year 1991 budget contains $10 million to initiate a $210 million program to develop a battle management system in Cheyenne Mountain for ASAT weapons once they are deployed. Mr. Welch, has a decision been made to actually deploy ASAT weapons? If not, why is the Air Force planning to build a battle managment system at this time?

Answer. The current DOD program is consistent with National Space Policy which directs development and deployment of an ASAT capability at the earliest possible date. Like all major DOD programs, the ASAT program will be reviewed by the Defense Acquisition Board at appropriate milestones to determine if the program should proceed to the next phase. Air Force efforts are consistent with the current phase of the development program.

Question. What is your requirement for an ASAT battle management system? What will it do, and how will it work?

Answer. The requirement for the ASAT system is documented in the USSPACECOM Multicommand Required Operational Capability for a Space Control Anti-satellite Capability (JCS document SM-77-88, 5 Feb 88) and in the JROC-approved Initial Kinetic Energy Antisatellite Requirements (JROC-009-90, 8 Feb 90). AFSPACECOM is developing a System Operational Requirement Document (SORD) for the battle management and surveillance part of the ASAT system. The battle management system will provide targeting data to ASAT weapons, develop mission plans for ASAT engagements, coordinate ASAT activities with other US space activities and the intelligence community, and perform mission assessment of previous ASAT engagements. The battle management system will integrate data from the Space Surveillance Network, the Intelligence Community, and US space system operators in the Space Defense Operations Center (SPADOC) in Cheyenne Mountain.

Question. When would such a system need to be operational under your current plans?

Answer. The system should become operational in ———.

Question. How does this schedule fit into the Army's kinetic missile ASAT schedule?

Answer. This is consistent with the Army's schedule.

Question. DOD is working both on near term kinetic ASAT and far term directed energy ASAT concepts. Which of these weapons does your proposed battle management system envision using?

Answer. The battle management system is being designed to control both types of weapons.

Question. If the Army is building the weapon, why doesn't the Army build the battle management system to fire it?

Answer. The Army is building the kinetic energy ASAT weapon-unique part of the battle management system and the Air Force is building the common elements of the battle management system. The Air Force is building the common elements, which will interface all ASAT weapons with the other Cheyenne Mountain systems, because of the Air Force experience as developer of the other Cheyenne Mountain command centers and communication systems.

Question. The Air Force has an extremely poor track record with computer upgrades at Cheyenne Mountain. Why not concentrate your efforts on fixing those chronic problems rather than starting off on a new tangent?

Answer. By congressional direction, the Air Force has consolidated its Cheyenne Mountain Upgrade (CMU) programs into a single effort which successfully met a Defense Acquisition Board in September 1989. The consolidated CMU program and the ASAT battle management program are working closely to integrate ASAT-required modifications into the appropriate systems.

Question. In what month and year do you plan to award a contract to develop this system? Will Congress have approved ASAT deployment by that time?

Answer. The battle management system contract award is planned for March 1991. The decision to deploy the Kinetic Energy (KE) ASAT will not be made until Milestone III (in fiscal year 1994) when production of the operational weapon is authorized. As always, Congress will be advised of DOD plans in the descriptive summaries which accompany our budget submissions, and Congressional approval of requested funds will indicate concurrence with DOD plans to proceed with deployment of the KE ASAT system when operational weapons are available.

[CLERK'S NOTE.—End of questions submitted by Mr. AuCoin.]

ADVANCED TACTICAL FIGHTER (ATF) AND OPTIONS

Mr. AUCOIN. Let me move on to the ATF. This may surprise you, but I have always been a supporter of the ATF. In fact, the record will show that I argued for it in last year's mark-up when virtually everyone else was against it.

This is one of the strange phenomena that sometimes occurs on Capitol Hill, but it nevertheless did occur. I felt that way and did that because it seems to me that this is one of the few areas of combat where head-to-head and one-on-one, we have to be better than the other guy, where there is no substitute for that.

But, as I look at the probable course of the world over the next several years, I think we are now heading for an airplane for which the bucks simply aren't going to be there.

I remember that the Air Force put itself into a situation not too dissimilar from that 15 years ago when you threw yourselves into the F-15, found that you couldn't afford as many as you wanted and you respond by cutting the F-15 in half to produce the F-16. And the F-16 went on to be an unqualifed success.

Now, your fighter of choice in the next generation seems to be not just a question of not being able to afford enough—as I read the tea leaves, it is a question of not being able to afford any, period, and it may be that to get a fighter of that technology you are going to have to cut the ATF in half, build the best fighter you can by using one ATF engine.

If you opt for that, your designers are going to scream, they are going to moan and groan and say it can't be done. That is exactly what they did back at the F-16 juncture, and they were wrong then and I suspect they would be again, if they responded in that fashion in this instance.

My question is, have you studied that option for the ATF given the circumstances we are faced with in the future?

Mr. **Welch**. General Ferguson talked to that before about some of the generic airplanes.

General **Ferguson**. Most assuredly, there was a single engine variant, I guess you would say, of the ATF studied in the MAR report, and basically what it found was that it just didn't have the legs and the payload in order to meet the mission of our tactical Air Forces. I guess just to talk generally at the thrust of the argument, watching deliberations ongoing within the Air Force today clearly indicate that the size of our force structure is going to be much less than what it is today. In regards to having the operators really own and respond for the acquisition budgets in that they are the people who vote and put monies into the budget in order to buy a modernization program, they, I think, have faced up very squarely to the potential costs and the affordability of the ATF and are supporting it strongly as we work through the painful decisions in the budget.

Mr. **AuCoin**. What is the proposed thrust of the ATF engines, per engine? Is it in the 33,000 pound range?

General **Ferguson**. I think that is about right, yes, sir.

Mr. **AuCoin**. And you are saying one of those engines does not provide enough thrust for a reconfigured F-16 type of variant of the ATF? In other words, a smaller, different plane?

General **Ferguson**. I was talking about a very different—the alternatives that were considered in the March study were two variants of the F-15, two variants of the F-16, and the airplane I described is a paper airplane, essentially a one engine version of the ATF, which would have the same sort of characteristics from the point of view of survivability——

Mr. **AuCoin**. It carried the same weight of the proposed ATF, but only had one engine?

General **Ferguson**. No, it is just a smaller airplane, because it is built around one engine. It has basically the same characteristics of stealth, survivability, and the ability to super-cruise. It doesn't have the legs, the range——

Mr. **AuCoin**. The thrust is not able to compensate?

General **Ferguson**. Yes.

Mr. **AuCoin**. Would another possibility be to update our existing fighters which presumably would be a lot cheaper than even half of an ATF, for example, what about resurrecting the F-16XL?

General **Ferguson**. That was one of the variants that was considered and the Crank Arrow version of the F-16 was another version that was considered. As I mentioned, several alternatives or variations of the F-15 design, were considered, as well. The MAR Committee did a very thorough, I think, evaluation of the potential alternatives and the outcome of that was ratification of the ATF, as the airplane of choice.

Mr. **AuCoin**. I know what your airplane of choice is. I am saying what if you were up against the brick wall on the affordability thing. I am not asking you to endorse that notion, but I think we ought to explore, without any inference whatsoever, certainly from somebody who has advocated the ATF, we ought to explore what the effects of certain alternatives would be if we do hit that wall.

What about the F-16XL as a possibility—would that present an improvement over existing capability? Could that be looked at as a way to modernize, yet obviously fall short of what the ideal solution is?

Mr. **Welch**. Maybe we communicated too well on that point. We are giving you conclusions, not off-the-top of the head. They result from a very detailed study of proposals that were submitted for the XL, for single engine ATFs, et cetera.

We would be happy to go over those in great detail. This was done in depth. This is not something that we began to run into an affordability problem and said, gee, we should go back and look at these things. In fact, today it is almost a policy statement that it is cheaper to modernize and improve what we have than it is to start a new program. The F-15 is really a 20-year-old airplane, the F-16, about 15 years old.

They have gone through multi-stage improvement programs. The one area that you cannot achieve the types of things you want is to change the various observable characteristics.

Mr. **AuCoin**. I understand that.

Mr. **Welch**. Once you get to that point——

Mr. **AuCoin**. The XL, though, has a lot of low observable characteristics, does it not?

Mr. **Welch**. Yes, sir. There are opportunities, and this is probably, again, not the level to speak of exact numbers—there are opportunities to improve the observability, but if you are going to say that the necessity for first look, first shoot, first kill is going to be required, and nobody has said that has changed—perhaps the quantities of those we might see, perhaps a few years of when we might see them—nobody has put forth something that makes that cut. It would be better today to just stand with what you have.

OPTIONS COMPARED WITH THE SOVIET THREAT

Mr. **AuCoin**. Leaving that aside, would the F-16XL leave us well ahead of the existing threat and the projected threat for the foreseeable future? The FULCRUM, the FLANKER, any immediate follow-up?

General **Ferguson**. It would be my judgment that it would probably be an airplane that would maintain parity.

Mr. **AuCoin**. With those?

General **Ferguson**. With those kinds of systems.

Mr. **AuCoin**. The 29,000 pound thrust engine with that that you already have—do the F-15s and F-16s now get back the energy maneuverability superiority over the FULCRUM and the FLANKER?

Mr. **Welch**. If you do a classic energy maneuverability curve, they are probably in today's environment about the same. They have some advantages in some areas of the spectrum, and we have some advantages——

Mr. AuCoin. I am talking about energy maneuverability?

General Ferguson. Yes, sir.

Mr. AuCoin. If I hear your answer to that question with your answer to the previous one on the F-16XL, there really is no difference between what you get with the F-16XL and what you have with the F-15, F-16 with the 29,000 pound thrust engine——

General Ferguson. You have to be a little careful. Let's return a minute to the discussion of the F-16 and the F-15. They don't do the same job. It wasn't that the F-16 was bought as a cheaper version to do all the things that a F-15 does. The F-16 is a swing-role airplane. It has strike capability, close air support, battlefield interdiction and contributes to the air battle.

The F-15 is the air superiority fighter. We are talking in the ATF, we plan to keep the F-16, and continue to improve it over this time period, including going up to the 29,000 pound engine. As you move to looking for air superiority over enemy territory, the F-16, whether you take the Cranked Arrow or Delta Canard, it is not survivable?

Mr. AuCoin. What about the F-15 with the 29,000 pound thrust engine?

General Ferguson. The F-16, even with the ATF engine, has not proven out—it is a problem of observability, not thrust. The idea is not to get into a hassle.

Mr. AuCoin. I understand that you may be up against a brick wall when it comes to moving soon on the low observable and the fighter aircraft. If that is what we run up against, what is the next best step that we could turn to to keep that edge that I think is critical in air combat.

Are you saying that using the ATF 33,000 lb. thrust engine in the F-15 and F-16 would not put us ahead of the Soviet threat?

General Ferguson. I think the answer is just yes.

Mr. AuCoin. It is?

General Ferguson. Let me go back——

Mr. AuCoin. Are you just saying that because they are not low observable?

General Ferguson. The evaluation to try to determine——

Mr. AuCoin. The Soviet threat I have just described is not low observable either. Are you saying our F-16s and F-15s retrofitted with the ATF engine can't shoot those guys out of the air, they are not superior to the FULCRUM and the FLANKER?

General Ferguson. We are not saying that. What we are talking about in the ATF is an airplane that will be available at about the turn of the century when the F-15 is over 30 years old and technology even older than that. So we are building an airplane for the future.

Mr. AuCoin. You are doing a great job. I am defending your request for the ATF. I want to move beyond that because I think it is important to explore some things that might be before us in the future. We might not be able to get the low observable characteristics in the next generation airplane.

I want to explore what we could do to keep that combat superiority edge in the air if that happens. I hope you are not saying that retrofitting F-15s and F-16s with 33,000 pound thrust engines would leave us behind the Soviet threat just because they are not low observable, because the Soviet threat is not low observable. As I look at it giving our F-15s and F-16s that kind of energy maneuverability capability, we still retain air superiority.

General **Ferguson**. If we were willing to live with the world as it exists today and only to modernize the current force of airplanes, the F-16 and the F-15, we would maintain parity with aircraft that will be modernized or of the current generation of the Soviets and we do not want to maintain parity, we want in the year 2000 to have a generational capability in a new air superiority fighter. So we looked at five measures of merit: first look—first kill, survivability, lethability sustainability and long range persistance for multiple engagements.

Mr. **AuCoin**. What is your assessment of what the Soviet capability will be at that point then in order to make the calculation that you need that?

General **Ferguson**. We believe the ATF will re-establish that generation lead in fighter aircraft.

Mr. **AuCoin**. Are you anticipating a low observable capability on the part of the Soviet fighter capabilities?

Mr **Welch**. The threat is assessed at the time period of the turn of the century that we will be seeing the follow-ons to the 27 and to the 29, and that, in fact, what the threat is being addressed to.

Mr. **AuCoin**. Do yo anticipate those being low observable?

Mr **Welch**. We certainly do.

DEFENSE SUPPORT PROGRAM (DSP)

Mr. **AuCoin**. Let me just—I appreciate your reponses. I am not trying to be hostile. You had a few friends last year on the ATF and I think it is important for us to begin to think about these alternatives. Let me move to DSP.

In the current year's appropriations, we directed that there be no slip in the production of DSP satellite 23 and onward. Has there been?

Mr **Welch**. Twenty-three to 25—I will have to check. I will have to check that for the record.

[The information follows:]

The procurement of DSP satellites 23-25 has slipped by one year. OSD deleted the fiscal year 1991 long lead funds for these satellites in order to realize considerable fiscal year 1991 savings. This caused a one year delay.

Mr. **Welch**. The DSP program, as a general statement, is on schedule. I can say that.

Mr. **AuCoin**. You will report back to the Committee?

SOVIET THREATS

Mr. **Welch**. Yes, sir. On the previous subject, we sometimes get a little bit tied up in these threats, but we have gone through and, in fact, during the recent aircraft review with Secretary Cheney, they had a complete reassessment and review of that threat with all agencies, CIA, DIA, et cetera. I would be happy to come over and show that threat review. If, in fact, you cannot get ATF-type capabilities, effectively you are going to drive the United States' ability to maintain air superiority back over friendly forces.

We would not anticipate being able to maintain our offensive counter-air, which is over enemy territory.

Mr. **AuCoin**. I will take you up on that briefing offer.

Mr. **Welch**. Be glad to.

Mr. **Murtha**. Mr. Miller.

DUPLICATION OF R&D EFFORTS

Mr. **Miller**. Thank you, Mr. Chairman. I see, General Ferguson, by your biography that you are well acquainted with Ohio, Wright-Patterson AFB and Ohio State University, and I welcome you and Secretary Welch here today. We are glad to have someone from Ohio.

General **Ferguson**. Thank you, sir.

Mr. **Miller**. When we are talking about the research and development funds being spent by each of the Services, I am wondering how much each depends on the other.

For example, there is a display in the Rayburn House Office Building on SDI which has spent billions of dollars on research and development. Much of that, I am sure, could be used in some of the areas that you do research on. In other words, I am wondering whether we have a lot of duplication.

Mr. **Welch**. I think General Ferguson has just come from having all of the laboratories of the Air Force reporting to him. I think he can give you a very good response on that.

General **Ferguson**. Sir, we certainly don't think so. I think to take the specific example of the SDIO program, much of their technology work is actually managed by service R&D organizations. In the case of the Air Force, our laboratory organizations are our major performer or overseer, I should say, of work that is contracted using SDIO funds. That is one way that we avoid duplication.

As a matter of fact, because we are an agent for many people like DARPA and the SDIO, we are able to leverage the dollars that the Air Force invests in science and technology so, therefore, if there really is an opportunity to actually get more for your dollar, probably we do it just because of the way we conduct our business.

Mr. **Miller**. So there is a regular interchange of thought and communication among the Services, and especially with SDI because there we are reaching out much further on technology and developing items that are useful.

My question really was whether you felt that we were not duplicating research but reaching out and communicating with the other services, as to what they have already developed.

General **Ferguson**. I agree with your statement. As a matter of fact, over the years if you look at various studies that have been done that delve into the issue of duplication, what you find is that because we often conduct work under the same generic title, it would appear that the work is being put towards the same objectives.

As you get into the detail, and you look at the actual content of the work, you find that that duplication, in fact, doesn't exist.

Mr. **Livingston**. Would the gentleman yield?

I asked the same question of some witnesses in another hearing just today, and the point was made that in a lot of these overlapping systems here, you are also dealing with the same contractors who are developing their same fundamental concepts, which enable them to transfer technology from one project to another in order to keep their costs down, so that there is a real incentive in the private sector to avoid that duplication.

It is an added thought.

Mr. **Miller**. It seems as though every year we go deeper and deeper and we come up with the new technology and it is very important that somehow we do not go parallel but we build on what other people have already devised and not waste additional dollars in the budget for someone else to start working on the same project.

It is not easy because of the many labs that we have and the many programs that are being worked on every day.

General **Ferguson**. Maybe just one other point. It often goes unrecognized, but technology that may be developed by one service is oftentimes first implemented by another, and I think a good illustration of that is the significant investment that the Air Force made into advance composites which, of course, now become one of the really underlying technologies for aircraft life of the B-2 and for the ATF.

But even though the Air Force made the major investment, the first application in a significant way was on the Navy's AV-8B airplane. So we don't perhaps talk enough about the kinds of synergism that you have described.

SUMMARY OF AIR FORCE R&D PROGRAMS

Mr. **Miller**. General, you had mentioned in the statement that you have provided a summary for each member of the Committee that describes our planning environment, investment strategy, science and technology program, but I haven't seen that summary. Is it forthcoming?

Mr. **Welch**. Yes. They will be available by the early part of next week. They are just being printed really.

EFFECT OF CURRENT WORLD EVENTS ON AIR FORCE STRATEGY

Mr. **Miller**. Very good.

Recent events in Europe may have profound effects on U.S. military strategy, can you tell us how recent world events will affect Air Force strategy.

Mr. **Welch**. I think that the kinds of things—a policy review to a degree is the best way to answer your question as a part of these major aircraft reviews.

As a general statement, I think that it reinforced most of the policy initiatives that we talked about before, which have to do with a global presence.

In fact, I believe the Air Force has made available to the committee a briefing that Secretary Rice and General Welch gave which was called "Global Power, Global Reach." It talked to the kinds of forward presence of modernized airlift, of modernized fighter forces, of penetrating bombers, but I think the best answer is that we certainly acknowledge that there has been a significant change in the threat and a significant change in the force structure of potential adversaries. We have not seen anything but an improvement, though, in quality of their systems, so that we may see them in less quantity, but we will see the same kind of quality. With the changing world situation of kind of pulling back forces into the United States and a shorter execution time, for instance, would tell us we definitely need to feature modernization of airlift as we talked about earlier today with the C–17.

We can provide a copy of that briefing, which is called "Global Power, Global Reach," which tries to recognize how the world has changed. It certainly recognizes we are going to have to be a much smaller force. It certainly recognizes that the first demand has got to be quality people. We have got to live up to the commitments we have made to people in terms of career fields, both military and civilian. I think it prioritizes those. I don't believe there is a great change in policy though because it has done pretty good for us so far, Mr. Miller.

[CLERK'S NOTE.—A copy of "Global Power, Global Reach" was provided for the Committee's files.]

TECHNOLOGY VS. HUMAN CAPABILITY

Mr. MILLER. We apparently are reaching out with new technology to the point where we may get ahead of man; whether the people are able to comprehend exactly what they have.

In our submarines, for example, I had an opportunity to take a look at the technology that has been applied there and it seems there is a terrific amount of training that it takes to back-up this technology with the manpower that is capable of understanding exactly what the piece of equipment is for. Do you have any thoughts along this line? Are you putting out technology without having proper manpower to truly be able to understand how to operate that equipment?

General FERGUSON. We have an entire aspect of our science and technology program that is really devoted directly to the questions that you pose, sir.

It is based at our Human Systems Division with work that is carried on in the Armstrong Laboratory at Wright-Patterson Air Force Base.

That is where it is focused, but the program has dimensions that reach into the cockpit to be sure that as, in fact, we are ever to put ever more capability in the hands of the pilot that, in fact, the workload can be managed and to intelligently use machine-type filters, machine intelligence, artificial intelligence in order to assist him in his job.

We have programs that are designed to help the enlisted person on the flight line to better troubleshoot and diagnose problems on the airplane so that, in fact, we can use his time more efficiently. We are thinking about a smaller workforce in the Air Force. We think that is one of the things where we have to have greater productivity increases. We are concerned about the environment, and that is the physical environment in which we work and our people will have to work and to pay attention to the changing laws in this country. So our program has many dimensions, but clearly one part of it is focused on the human.

Mr. **Miller**. Thank you.

Mr. **Murtha**. Mr. Livingston?

BOOST SURVEILLANCE AND TRACKING SYSTEM (BSTS)

Mr. **Livingston**. Thank you, Mr. Chairman.

Gentlemen, what is the status of the BSTS system? Has it been taken out from under SDIO and placed under the auspices of the Air Force as the predominant tactical warning and surveillance system?

Mr. **Welch**. When the SDIO officials were over, they concluded that the BSTS system as defined for them before is not essential for their present architecture, so they are considering turning that back over, as I understand it, to the Air Force for addressing the modernized tactical warning attack assessment (TW/AA).

In fact, we will be meeting with them this afternoon on that subject. As you know, it was always planned that the Air Force, even for the SDIO, would have developed that system and we have funded to take over that development. Again, I understand that they would pass the money that was associated with BSTS back so that we would have effectively a whole budget.

Then we will address ourselves to an update to make sure all of the using and supporting CINCs have their TW/AA functions squared away and we would intend to proceed on probably roughly the same schedule that they plan to proceed.

Mr. **Livingston**. Which would include full-scale development in fiscal year 1991?

Mr. **Welch**. It would include full-scale development. I have to say to the best of my knowledge, in 1991, since we have not gone back and completed all analysis with respect to that requirement. We also, of course, have to look at the present DSP—I think in previous years you directed that we look at improved DSP. We believe we can complete all those things and essentially hold the schedule.

I believe that they were planning to try to get their RFP out in 1990. That may be just a little bit early.

We fully support that program in the Air Force and have plans to fully fund it.

Mr. **Livingston**. But there may be restructuring decided upon?

Mr. **Welch**. The job to be done is different.

If you are just doing TW/AA then you do the job you would have if SDIO had planned for it.

CHEYENNE MOUNTAIN

Mr. **Livingston**. Last year, the upgrades for Cheyenne Mountain were expected to cost $1.3 billion and were several years late.

Mr. **Welch**. $105 million is requested in fiscal year 1991 for them.

Mr. **Livingston**. What management improvements have been made during the last year? Are we better off?

General **Ferguson**. I think as you are aware and partly as a result of observations by the Congress, we made major changes to the way we are managing programs that are being conducted in the mountain, and so we have put all of the various programs that you might consider in that package of programs under an Air Force executive program, which streamlined that management.

We baselined it and we think we are reporting now against that.

We have assigned that program to a PEO, a program executive officer for command and control and communications.

That is Major General Nelson, who directly reports to Mr. Welch, and the System Executive Manager, of course, has been designated as the Air Force Space Command.

The program director has put together a good configuration control system now to manage all the changes and the integration of the various programs that are going into the upgrade program within the mountain so we believe that there have been significant management improvements made over the last year or so.

Mr. **Livingston**. What is the current cost estimate for this initiative, and why has it increased so much since last year?

General **Ferguson**. Well, it would appear to have increased significantly, but that is probably masked by the fact that we have integrated the program and we are now reporting it as a matter of—I think there are six programs actually that make up the set. So it is that merge and reporting as an intergrated program that I think gives you the impression of a significant cost increase and not actually a cost increase in the mountain upgrade.

Mr. **Livingston**. Do you want to supply those numbers for the record or do you have them available?

Is it $1.6 billion?

General **Ferguson**. Yes, sir; $1.58 billion, and it is made up of the survivable communication and integration system, $188 million, approximately, the Space Defense Operations Center, which is $473 million; the communication system segment replacement, $323 million; the command and control processing display system replacement, $289 million; the program referred to as Granite Sentry, which is an integrated air, space and missile space warning display system, $186 million; and then the Offutt Processing and Correlation Center for $122 million.

It is integration of all that work that I referred to earlier.

Mr. **Livingston**. That is a total of $300 million more than last year. Can you explain the difference?

General **Ferguson**. That is because we didn't have the Offutt Processing and Correlation Center in the figures last year.

Mr. **Livingston**. The Director of Operational Test and Evaluation's recent annual report to the Congress states:

> The Cheyenne Mountain program, while focusing on the implementing systems, does not specifically address the integration of contributing and implementing systems needed to fulfill the JCS-validated requirements.

Why are we spending so much for a system that apparently does not meet requirements?

General **Ferguson**. Well, we believe that since that report was created, that we now have an agreement on just exactly what the statement of operational requirements is and that we are now basically in agreement on the upgrades going into Cheyenne Mountain.

Mr. **Livingston**. I hope so. What is the status of the SPADOC upgrade which appeared last year to be very poorly managed?

General **Ferguson**. Well, since—I guess I would say—we got our arms around the problem things have been proceeding very well. As a matter of fact, I can report to you that we are actually slightly ahead on the SPADOC software development now and our next major entity is anticipation of the IOC in May of 1991.

Mr. **Livingston**. In the annual report I noticed that they made a commentary about SPADOC and said if they wanted to get information about it, they would do better picking up the phone and making a telephone call.

I would like to read that quote:

> The system depends on space status messages from the owner/operator to receive information. However, the crew can get the information more quickly by telephone call.
>
> Overall, we are concerned about the difficulties experienced in obtaining operational capability with a segment of the CMU upgrade.

That is pretty serious. We have never discussed the Granite Sentry part of the Cheyenne Mountain upgrade in any detail. The recent Director of OT&E's report states:

> It is the DOT&E assessment that findings on individual measures of effectiveness reflect the system did not attain the requisite capability.

What is Granite Sentry? What is its cost? Is it in trouble, too?

General **Ferguson**. Well, Granite Sentry is, I guess, what you would call where it all comes together in the mountain because that is the processing displays that are used in the NORAD Command Center, which is where we do our air defense command and control and battle staff functions.

It is a phased acquisition—by that, I mean we build a little, test a little, to put it on line so it is not a major off-line sort of development and then placed into the mountain. It is a little bit each year. We have found that that is the very best way to upgrade the operation center and at the same time be able to maintain the capability that is necessary for NORAD. I guess I would say that the DOT&E report was concerned that the System Executive Manager, which is the Space Command Commander, declared the IOC while there were still software deficiencies in the system.

I guess you can have different views of that. Our view and his view obviously since he is the operational mission commander was that those deficiencies were not sufficient to have not proclaimed the system to be operational or he viewed those deficiencies could be corrected downstream and he was much better off to go ahead with the capability and begin to use it in his wartime mission.

We are, in fact, working those minor deficiencies off and we think from the reports that we are getting from General Moorman that the program is on track.

Mr. **Livingston**. I hope so, General.

If I read all of the remarks on the OT&E report, in effect what they are saying is it doesn't work. So we have got to come a long way on that one. For the record, would you provide a detailed breakout by appropriation, fiscal year, R-1/P-1 line item, and project all funding for the $1.6 billion Cheyenne Mountain upgrade? That is all I have, Mr. Chairman. Thank you.

Mr. **Welch**. Yes, sir.

[The information follows:]

Cheyenne Mountain Upgrade [CMU] Program

	Million
Project 001 3880 CMU: R-1 (Resources):	
Prior	$560.6
Fiscal year:	
1990	110.8
1991	100.7
1992	122.0
1993	162.2
1994	106.4
1995	51.8
1996	18.9
1997	2.2
Total	1,246.4
Project 001 3880 CMU: P-1 (other procurement):	
Prior	197.9
Fiscal year:	
1990	30.6
1991	10.0
1992	26.0
1993	18.5
1994	38.8
1995	3.7
1996	0.0
1997	0.0
Total	334.4
CMU Total	1,580.8

Source: Defense Acquisition Executive [DAE] Approved Program Baseline [APB], Feb. 12, 1990.

Mr. MURTHA. I want to comment on Cheyenne Mountain because this Committee was so instrumental in making sure we got that under control.

I agree with what you said, General. We had the operational commander here and he didn't know what was going on there. It took three months to get the thing at least started in the right direction. We hope you are pursuing that and supervising it closely on the R&D side, but we still believe that the operational commander is the one who has to bear responsibility because he is the one who is going to use it.

Mr. WELCH. Last year, General Moorman was here testifying with me and he is now the Air Force Space Command Commander, so he is sensitive, and the Air Force Space Command Commander is CINC Space. We hear from them.

Mr. MURTHA. Good.

Mr. MILLER?

AFT DECK CRACKS ON THE B–2

Mr. MILLER. Thank you, Mr. Chairman.

I would like to hear a little more about the B–2 and the cracks that you speak of and the planes flying around now with patches on them, patches of titanium.

How many planes would you say have units that are cracked?

Mr. WELCH. We have one airplane, sir, that is flying in that situation, and at the moment, as far as envelope expansion is concerned in the night test program that is going on, it does not bother that either from a flight test or from a safety of flight standpoint.

We have had one full flight with this patch on and, in fact, it is in the air right now for a second flight. We have six small cracks that we found during inspection after the airplane had been on the ground from the last series of flight tests about the 30th of March. We do not have an answer for that. We expect before the end of this month that we will have an understanding of what the problem is. It is a very heavy, large piece of titanium. It has a compound curvature. It is in a high-temperature environment, a very powerful acoustic environment, and we will have to see. In the short-term, there is no problem with continuing our flight test program. In the longer term, it would bother our low observability testing. I don't want to give you the idea that it is not something that we are paying a lot of attention to. I don't have the answer now, but it is not impacting the program at the moment.

Mr. **Miller**. In production, this would need to be changed, whatever dies they use, whatever presses they use in order to fashion this one piece of titanium. You said it was one of the largest presses in the world that formed that particular piece. Is that something that you and the Air Force will be responsible for? Will that have to be replaced and does the contractor help pick up the tab on such items as this?

Mr. **Welch**. Go back to the first part.

Our feeling at the moment is that the problem is not necessarily in the part, that superior plastic form. It has other pieces that are attached to it and some machining after that. It may be that the way that it is machined out and the sections spinned to allow air to go through for cooling of that deck and the way that it is restrained by the rest of the air vehicle may be contributing to this problem so we are not sure that we have to do anything at all right at the moment perhaps to that press. To go on, this is a development program, so where we have used all of our best analytical techniques, whether they be the government or the distributors and have come up with a case that we have not seen before, that is certainly a part of the cost-type development contract that is going on.

So we would, in fact, pay for that. The only parts that have been made are those parts that are supporting the full-scale development program. There have been no production parts made yet.

Mr. **Miller**. Didn't we have some type of a problem such as that on the B-1B also?

Mr. **Welch**. No, sir. I don't believe so, with respect to cracking. This is a particular kind of environment. In fact, the analysis work that was done on this really kind of pressed our analytical efforts to be able to predict the stresses, and particularly the imposed stresses from the heat and acoustic environment.

General **Ferguson**. No, I guess I am not personally familiar with the B-1 problem.

It is not unusual, however, to find that particularly in the vicinity of engine exhaust where structure extends beyond the exit for the gas path where you have a very high noise level, to find problems where the structure does not stand up to its environment. One of the things that we have developed over the years coming out of the technology program are new materials that allow us to dam structure, and to minimize the vibration, not to suggest that

that might be a technique for a solution to this because we really don't know the cause of the cracking at this time.

But there are other alternative ways that one might be able to approach a problem like this if, in fact, that is the cause of the problem.

Mr. **Miller**. When you speak of new materials, do you feel that you have something better than titanium as far as strength and withstanding the heat is concerned?

General **Ferguson**. No, sir.

These are materials that are elastomeric that cause the part not to vibrate or to vibrate much less and, therefore, minimizes the damage that the part is seeing in the environment.

Application of this kind of technology is common. You are seeing many of these materials applied under the hood of newer automobiles, particularly in big trucks on the highways to minimize sound and for you to drive the car with more comfort, they are being applied in the commercial sector as well.

Mr. **Miller**. Very good.

Thank you.

Mr. **Murtha**. Thank you very much, gentlemen. We will have some questions for the record, and Mr. Hefner has some questions for the record also.

The committee will adjourn until 1:30 p.m. Tuesday.

[Clerk's note.—Questions submitted by Mr. Hefner and the answers thereto follow:]

AIRBORNE SELF-PROTECTION JAMMER (ASPJ)

Question. Mr. Secretary, the Air Force cancelled the ASPJ program this year. Recent news reports indicate you plan to develop another solution beginning in Fiscal Year 1992. Are you doing anything about this now?

Answer. Considering the Air Force terminated its participation in the Airborne Self-Protection Jammer program due to affordability, the Air Force does not have any programs for another off-the-shelf F-16C internal jammer. Our back-up solution is to use electronic countermeasures pods in conjunction with radar warning receivers and chaff/flare dispensers to provide self-protection for these aircraft. The pod program is an on-going program and not a new start.

Queston. Do you plan to spend any money to address this problem in fiscal year 1991? If so, would you explain this to the Committee.

Answer. When the Air Force's Airborne Self-Protection, Jammer Program was terminated all outyear funding for an F-16C internal jammer was zeroed. Since the electronic countermeasures pod program is an on-going one, funds are available in fiscal year 1991. We will continue to procure ALQ-184s in fiscal year 1991 and beyond. When added to the ALQ-131 Block IIs already purchased TAC Air Force will reach its 1500 "quality jamming pod" inventory goal. Tactical Air Command, taking the cancellation of ASPJ and operational need into consideration, will allocate these jamming pods.

Question. How long do you think it will before you can field an internal protection system for the F-16? Will this be a fly before you buy system?

Answer. There are no funds available, or projected, to pursue another off-the-shelf internal jammer for the F-16C.

Question. How much do you plan to request in fiscal year 1992 for this initiative?

Answer. We will not pursue any funds in fiscal year 1992 for an off-the-shelf F-16C internal jammer.

JOINT TACTICAL INFORMATION DISTRIBUTION SYSTEM (JTIDS)

Question. The Air Force is a participant in the JTIDS program with the Navy and the Army. Could you provide the Committee with the current status of that program.

Answer. With the awarding of two initial production contracts in March 1990, the Joint Tactical Information Distribution System (JTIDS) starts production of its second generation terminal—a highly jam resistant, secure digital information distribution system for use in joint tactical combat environments. This generation of JTIDS terminal will provide all US services (air, ground, and naval forces) with an accurate, selective, timely, and efficient combat data exchange capability.

The first generation, the Hughes Class 1, has been in operational use with the Air Force and Army, in AWACS and ground sites on three continents (US NATO, and Korea), since 1985 and has exceeded expectations in reliability and operational utility. The Plessey (formerly Singer Co.) Class 2 terminal will provide all four Services with an increased capability for digital information transfer. Although early reliability and maintainability problems prevented an earlier production decision, the Class 2 terminal has now demonstrated satisfactory progress in all areas. Approval for a low rate initial production was given in September 1989 by the Defense Acquisition Board. The approved acquisition strategy provides for two competitive producers: Plessey Electronic System Corporation of Wayne, New Jersey and Rockwell-Collins of Cedar Rapids, Iowa. The first year production lot for each is a directed split of near 50-50. Following production verification and additional testing, a competitive bid process will be used. These first terminals are scheduled to be installed on a limited number of Air Force F-15s for the purpose of tactics and doctrine development. All Air Force Command and Control platforms are scheduled to be outfitted with this second generation capability starting with installation beginning in 1994 and ending in 1999.

Meanwhile, Naval integration of the JTIDS Class 2 terminals onto F-14 and E-2C aircraft is progressing satisfactorily as recent successful tests have demonstrated. Following a March 1991 program review highlighting terminal reliability, the Navy could begin installing operational aircraft terminals as early as 1993.

The Army's JTIDS Class 2M terminal, a more advanced technology derivative of the Class 2 terminal, continues to make satisfactory progress in development. This terminal will be the cornerstone of the Army's Forward Area Air Defense, Command and Control (FAADC^2) System and will meet the Army's defense needs well into the twenty-first century. The Class 2M configuration should be ready for a production decision in October 1991 with terminals being fielded as early as 1993.

[CLERK'S NOTE.—End of questions submitted by Mr. Hefner. Questions submitted for the record and the answers thereto follow:]

CHEYENNE MOUNTAIN

Question. Last year the troubled computer upgrades for Cheyenne Mountain were expected to cost $1.3 billion and were several years late. $105 million is requested in FY 1991 for them. What is the current cost estimate for this initiative and why has it increased so much since last year?

Answer. The FY 1989 Air Force estimate was $1.247 billion for five separate program acquisitions. These were the Survivable Communications Integration System (SCIS), Communications System Segment Replacement (CSSR), Space Defense Operations Center (SPADOC), Command Center Processing & Display System-Replacement (CCPDS–R), and Granite Sentry. Cheyenne Mountain Upgrade (CMU) Program also folded in a sixth acquisition, the Offutt Processing and Correlation Center (OPCC), with its budget of $122 million. Program budget changes, since last year, support intra-program integration tasks, consolidated schedule adjustments, and changes to program content to match current validated requirements for a total cost increase of $209 million. The six CMU acquisitions, plus the associated integration costs, now total $1.58 billion.

Questions. The Director of Operational Test and Evaluation's recent Annual Report to the Congress states: "the Cheyenne Mountain program, while focusing on the implementing systems, does not specifically address the integration of contributing and implementing systems needed to fulfill the JCS-validated requirements." Why are we spending so much for a system that apparently does not meet requirements?

Answer. CMU is the program to replace and upgrade a component (what DOT&E calls the "implementing systems") of the integrated Tactical Warning/Attack Assessment (TW/AA system. It is not an upgrade of the entire TW/AA "system of systems." Air Force Space Command, the operator, has bounded the set of requirements that CMU must meet in their System Operational Requirements Document, or SORD. These CMU requirements are derived from the JCS-validated requirements for the overall integrated TW/AA system. Since the Director of Operational Test and Evaluation's Annual Report was issued, Air Force and DOT&E have agreed that the CMU systems will be tested against the technical and operational parameters identified in the Air Force Space Command SORD.

Question. We have never discussed the "Granite Sentry" part of the Cheyenne Mountain upgrade in any detail. The recent Director of OT&E's report states: "It is the DOT&E assessment that findings on individual measures of effectiveness reflect the system did not attain the requisite capability." What is Granite Sentry, what is its costs, and is it in trouble too?

Answer. CMU includes upgrades to the NORAD Command Center's three warning mission areas: SPADOC for space warning, CCPDS-R for missile warning, and Granite Sentry for both air warning and new, integrated displays of all three types of data. Granite Sentry is a phased acquisition, with new capabilities coming on-line almost every year until CMU Full Operational Capability (FOC) in FY 1996. Granite Sentry (GS) Phase I provides upgraded air warning display processors in the Air Defense Operations Center (ADOC) and the NORAD Command Center (NCC).

Granite Sentry software is being designed and developed by AF Space Command with Electronic Systems Division as system integrator. Total program cost estimate is $185.8 million, with $21.0 million RDT&E funds requested in FY 1991.

DOT&E was concerned that the System Executive Manager (Commander, AF Space Command) had declared Initial Operational Capability (IOC) in February 1989, even though there were still some software deficiencies. The System Executive Manager (SEM) bases an IOC decision on more than Initial Operational Test and Evaluation (IOT&E) results—in particular, whether the new system has the potential to cause false warning, degrading the integrity of the whole Integrated Tactical Warning/Attack Assessment (TW/AA) System. In this case the SEM determined the Integrated TW/AA System integrity was maintained, all major (Category I and II) software deficiencies had been corrected, and the new processors provided a quantum improvement in operational capability over the old display system (e.g. can handle 1000 vs 25 aircraft tracks, maintains the track history, processes tracks 30–60 seconds faster, provides 27 color displays vs 1 monochromatic display, adds pan and zoom capability, etc.). On that basis the SEM elected not to wait for the final few minor software fixes before starting operations. The remaining software deficiencies were corrected and incorporated into Integrated TW/AA Systems routine software releases in April and September 1989.

MX RAIL GARRISON

Question. The fiscal year 1991 budget request includes $548 million in R&D and $2 billion in Procurement for the rail mobile MX missile.

Given decreasing Department of Defense budgets and arms control negotiations, what is the advantage and the cost of maintaining both the Small ICBM and the MX Rail Garrison.

Answer. ICBM Modernization is now and has been a sequential process of modernization. Peacekeeper Rail Garrison mobility will redress, in the near term, the issue of ICBM vulnerability with a low technical risk and lowest cost, near term solution. We redeploy all 500 Peacekeeper warheads into a survivable mode for approximately $6.4 billion in fiscal year 1990 dollars ($7.128 billion in Then Year $). As the Small ICBM is deployed, we gain increased stability and additional ICBM force mobility with the significant advantages of a "high price to attack," single reentry vehicle system, and an enhanced targeting flexibility over MIRVed missile systems. We deploy 500 Small ICBM warheads in a northern basing scenario for approximately $29.5 billion in fiscal year 1990 dollars ($41.9 billion in Then Year $). Both programs together provide us with a stable, survivable, high-quality ICBM deterrent force as the nature of the threat evolves and changes in the coming years.

SMALL ICBM

Question. The fiscal year 1991 budget requests $202 million to continue development of the Small ICBM. Do you still plan to achieve a fiscal year 1997 "Initial Operating Capability (IOC)" as was announced last year?

Answer. The fiscal year 1990 and fiscal year 1991 President's budget supports a fiscal year 1997 FAD/IOC, as the Air Force continues to support the President's two missile program (PKRG near term, followed by Small ICBM). However, the Air Force, like all of DOD, is examining its out-year budgets in light of possible force structure changes in response to the changing world environment. Small ICBM may be affected by these force structure changes and their budgetary impact.

Question. What work is being done on a "two-warhead" version of the missile?

Answer. There is no work being done on a "two-warhead" version of Small ICBM. The 37,000 pound Small ICBM has the inherent capacity for a second warhead with some redesign work. The Small ICBM Program Office (SPO) is technically protecting the option for a two RV configuration. However, the additional weight would range limit the missile to Minuteman (Northern) basing. The cost to modify the single RV design with a second RV is $315 million (then year $) and must begin in fiscal year 1992 to preserve a fiscal year 1997 FAD/IOC. As with the basing decision, the SPO is currently preserving the option for 1 or 2 RVs as directed by the Administration. We anticipate a configuration selection before reentering basing full-scale development in fiscal year 1992.

Question. What work is being done on the mobile launcher, and how much is budgeted in fiscal year 1991 for it?

Answer. The Small ICBM restart program contained only enough funds to proceed with missile work until basing restart in fiscal year 1992. There is some basing risk mitigation work being done to reduce high risk areas. The Hard Mobile Launcher (HML) has been successfully tested in both Northern and Southwest environments. The only Engineering Test Unit (ETU) is stored at Malmstrom AFB in full operating status. The next step in HML Mechanical testing involves hardness transitions from soft to hard configuration in grassy Northern soils with a redesigned front grouser blade. These tests are considered less taxing than those already completed on frozen soils. The Weapon Control System (WCS) has completed brassboard testing and established the protocol for the Intra-wing Communications (IWC) system. In fiscal year 1991, WCS development will continue with preliminary design of the modem controller leading to Preliminary Design Review in fiscal year 1991. Also, a WCS field test in fiscal year 1991 will verify performance of the IWC UHF radio. The planned fiscal year 1991 effort is approximately $25 million for HML and WCS development.

Question. The Air Force's cost estimates for Small ICBM have been steadily declining. What is the current "program acquisition cost" (R&D and procurement) estimate in both constant and real dollars?

Answer. The current acquisition cost (RDT&E, Procurement and MILCON) for Small ICBM under the baseline program (500 UE configured with a single RV on Minuteman basing) is $29.5 billion or a To Go Cost (fiscal year 1991 and out) of $25.9 billion (fiscal year 1990). In Then Year dollars this is $41.9 billion or a To Go Cost $38.6 billion.

Question. When full-scale development was authorized for the original program (December 1986), the approved number of developmental flight tests was 22. Does the new program schedule include 22 tests? If not, why and is this wise?

Answer. No. The current Small ICBM flight test program consists of 16 RDT&E flight tests. The first flight was in May 1989 and the second flight is scheduled for the 4th Qtr of calendar year 1990. The 16 flight test program is the SPO's assessment of the number of flights required to satisfy flight test program objectives. The reduction in flights from the original 22 flight test program is made possible by eliminating back-up flights that are no longer deemed necessary due to development and risk reduction progress to date.

LOWERING THE COST OF THE SMALL ICBM

Question. In its 1989 Annual Report on Air Force projects, the RAND Corporation stated that changing system components could lower costs. Specifically, RAND addressed the advisability of changing the guidance system. The Advanced Inertial Reference Sphere (AIRS) guidance system which was developed for the Peacekeeper and is currently used on the Small ICBM, is expensive to procure and maintain. New guidance technologies currently in development could be both less expensive and more reliable. Do you believe that current technology could produce a less expensive and more reliable guidance system?

Answer. The Air Force conducted a formal study in the fall 1989 to examine guidance options for the Small ICBM. The study effort included RAND and an independent review team (IRT) to review the technical feasibility, cost and schedule for small ICBM guidance options. The RAND and IRT ideas were incorporated into the study results.

The study indicated that other alternatives for Small ICBM could be developed that would produce a less expensive and more reliable guidance system in time for the Presidentially directed 1997 FAD/IOC. However, the program would face increased schedule risk and an additional $700 to $900 million of up-front (beginning in fiscal year 1991) development cost. This analysis has been continually updated to include the most current AIRS reliability and acquisition costs.

Question. What would be the effect, in terms of additional development cost and time, on the Small ICBM program, if a new guidance system was introduced at this time?

Answer. The key results indicate:

A. Reliability is no longer a life cycle cost (LCC) driver at mean time between failure (MTBF) levels beyond 10,000 to 15,000 hours.

In mid-1989, Advanced Inertial Reference Sphere (AIRS) cumulative reliability (mean-time-between-failure [MTBF]) was about 2800 hours. Performance over the last six months has averaged 5200 to 6000 hours. Continued improvements to 7000 to 8000 hours are expected through normal maturation. Reliability for the alternative systems considered as study options are estimated to be a minimum of 12,000 hours even through they all contain one electromechanical accelerometer (SFIR) on the thrust axis.

AIRS acquisition costs have been reduced drastically in a competitive environment, but AIRS is mechanically complex and will never be easy to repair. Options are available that would be simpler to build and much easier to repair than AIRS.

B. The options require an up-front investment of $700 to $900 million of which $50 to $100 million would have to be available in early fiscal year 1991 to support a fiscal year 1997 Small ICBM IOC. Since no fiscal year 1991 funds are available and no procurement planning has started, there would be a significant delay to the Small ICBM schedule to use any of the options.

Options based on available technology still must use one electromechanical accelerometer (SFIR) on the thrust axis. The SFIR is the highest failure item in the current AIRS system which uses three SFIRs. Advanced concepts are being worked that would use all solid state instruments, use modular architecture, and would be designed to reduce overall support costs. However, such options would not be available until beyond the year 2005.

With either 5 percent or 10 percent discounting of future funding flows, it is not clear that LCC savings will result from any of the options considered, due to the high up-front investment costs required for development and integration into Small ICBM.

DIRECTED ENERGY WEAPONS/ASAT

Question. The Army and Air Force are doing research into directed energy weapons for ASAT purposes. The Army has been designated by OSD to be executive service for the near-term kinetic (missile) ASAT, but who will be chosen to develop the longer-term directed energy ASAT has not yet been determined.

What work is the Air Force doing in directed energy (DE) research?

Answer. The Air Force is conducting S&T efforts in the development of laser devices, advanced optical components, optical beam control, atmospheric compensation, high resolution imaging, phased integrated laser optical technology (PILOT—coherent semiconductor laser diode arrays), high power microwave (HPM) technology, target vulnerability analysis, and system performance/mission effectiveness analysis.

Question. Is this work solely for ASAT applications?

Answer. Although the major near-term goal of Air Force DE research is to investigate technology for DE ASAT systems, not all of these research efforts are solely for this applications. HPM and PILOT technologies are examples of DE research efforts addressing other applications.

Additionally, much of the technologies currently being emphasized for ASAT applications may also have significant utility in other missions. Examples include technology development for the Chemical Oxygen Iodine Laser (COIL) device, atmospheric compensation, optical beam control, and high resolution imaging.

Question. In what other roles would directed energy weapons have utility for the Air Force?

Answer. PILOT technology can be used in many applications; examples include low power secure laser communications between airborne command posts or moderate power for optical countermeasures. HPM systems can be used in an airborne or ground environment to disrupt/kill enemy electronic. Atmosphere compensation and high resolution imaging technologies can be used in space object identification/surveillance/reconnaissance. COIL device, optical component, and beam control technologies may have applicable in various tactical applications.

Question. How does the Air Force plan to participate in the OSD sponsored competition between the Services to develop DE ASAT weapons?

Answer. The Air Force is specifically orienting DE ASAT technology development, target vulnerability analysis, concept definition, and system performance/mission effectiveness analysis to support the upcoming Defense Acquisition Board DE ASAT Milestone I decision.

Additionally, the Air Force is cooperating with the Army's DE ASAT technology development program to ensure that critical technology issues are addressed; to avoid duplication of effort between the service programs; to address mission requirements and the optimum mix with the Kinetic Energy (KE) ASAT system through mixed force studies; and to support the Cost and Operational Effectiveness Analysis (COEA) and the required documentation for the DE Milestone reviews.

Question. How much is budgeted by the Air Force in fiscal year 1991 for DE research, and how will these funds be used?

Answer. The funds for S&T development of directed energy (including high power microwaves) are:

PE 62601F, Advanced Weapons: $12.8 million in DE projects. Efforts include Directed Energy Weapon (DEW) lethality, vulnerability/survivability of US systems to DEWs, short wavelength laser device concepts, optical component technology, DE phenomenology, and HPM concepts development.

PE 62202F, Human Systems Technology: $3.7 million in radiation hazards (DE) project. Efforts include research in safety, environmental impact, and biological effects of exposure to HPM, laser, and ionizing radiation.

PR 63605F, Advanced Radiation Technology: $55.5 million in DE projects. Efforts include the development and demonstration of technology for nonlinear optics, high resolution imaging, PILOT semiconductor laser diode arrays, optical beam control (acquisition, pointing, and tracking), atmospheric compensation, advanced optical components, COIL device, excimer laser devices, and HPM devices. Efforts also include weapons segment system concept definition and mission effectivness in various applications, including HPM susceptibility/vulnerability/lethality, satellite target vulnerability to lasers, concept definition studies, and modeling/analysis to support segment system performance analysis, mission effectiveness analysis, and mixed force studies.

Question. Explain how the Air Force's approach to DE ASAT differs from the Army?

Answer. The Army is concentrating on the current residual ASAT capability of the existing MIRACL/Sealite Beam Director system at White Sands Missile Range and on the applicability of their SDIO-funded Free Electron Laser development program to the DE ASAT application. The Air Force is considering other laser device concepts, including the COIL and excimer laser concepts based on their respective candidate systems.

In other areas, the Army and Air Force are cooperating on the investigation of critical technology, including beam control, atmospheric compensation, optical components, target vulnerability, and mixed force studies. Respective service efforts consider technology alternatives in critical areas, particularly atmospheric compensation, with a goal that the feasibility, performance, and technical maturity of DE ASAT technology will be established from the combined results of both service programs.

Question. What Air Force requirements would be met by DE ASAT system that cannot be met by Army's KE system?

Answer. The overall requirements for ASAT capabilities are Unified Requirements documented in the Multicommand Required Operational Capability (MROC) 03-87 for a Space Control Antisatellite Capability. These USSPACECOM ASAT requirements call for a cost effective mixed force of DE and KE ASAT weapons.

Primarily, DE ASAT weapons offer a response flexibility not inherent in KE ASAT interceptors, that is, a DE ASAT system can potentially engage threatening space systems or sysems that support enemy operations at various response levels to either disrupt, degrade, or kill them.

In addition to response flexibility, there is a real operational synergism between KE and DE ASAT weapons as stated in the OSD ASAT Report to Congress, dated February 1990. Specifically, KE interceptor weapons are a key priority for low altitude ASAT capability because of the following characteristics: they typically have broad cross-range coverage at low altitude (where many key targets orbit), thereby having more opportunities for early engagements; they are not limited by weather; and they produce catastrophic destruction of the target upon intercept, so that target hardening is all but impossible and a kill is easily verified. The major drawbacks of KE ASAT weapons are: a fixed number of "shots" once production has ended; well-defined altitude limitation (sharp falloff in lethality); target countermeasures such as maneuverability, decoys, flares/jamming, and spares; and the subsequent task of debris management, involving both surveillance/tracking and potential collateral damage to friendly space assets.

On the other hand, DE ASAT weapons offer several complementing advantages: they have an essentially unlimited number of low cost "shots"; they can rapidly respond to target maneuverability; and kill a satellite without creating a significant amount of debris; and they have a gradual fall-off in lethality with respect to altitude. The inherent weaknesses of cloud cover limitations; potential target hardening, shielding, and rotation; and a more limited cross-range (than KE) at low altitude are directly complemented by the KE ASAT weapon.

B-1B ADVANCED RADAR WARNING RECEIVER

Question. In fiscal year 1991, the Air Force is requesting $46 million to correct deficiencies in the B-1B's radar warning system. In fiscal year 1990, Congress denied funding to develop or integrate the planned Advanced Radar Warning Receiver (ARWR), ALQ-161 program for the B-1B.

Justification material submitted with the 1991 budget request states that recent flight tests of the ALQ-161 highlighted design deficiencies of the system. Based on these system shortfalls, what are your plans for fiscal year 1991?

Answer. ———. Strategic Air Command recognizes the importance of situational awareness and ranks it as their top electronic countermeasures priority. Therefore, our intentions in 1991 are to complete the risk resolution studies begun in 1989 and subsequently halted by congressional direction in 1990, and to initiate RWR development on the B-1B. Through these studies and a nonconcurrent development program with performance milestones, we will reduce the risk associated with integrating the ALR-56M onto the B-1B aircraft. During 1991 we will also begin development of software and necessary hardware to allow integration of the ALR-56M onto the B-1B.

Question. What impact has the Loral and Litton contract dispute over the ALR-56M ARWR had on schedule for this program?

Answer. In Fiscal Year (FY) 1988, the Air Force determined that it was necessary to incorporate an Advanced Radar Warning Receiver (ARWR) into the B-1B to supplement on-board defensive avionics equipment. In FY 1989, risk reduction study contracts were awarded to Rockwell International and Boeing, with participation by Loral. These study contracts were prerequisites to integration of the selected ARWR (AN/ALR-56M) into the B-1B. The Air Force conducted these studies in fiscal year 1989 and intended to continue them in fiscal year 1990, with Full Scale Development (FSD) and actual ARWR production to follow in subsequent years.

In January 1989, Litton Applied Technology Division, who had competed against Loral for the ARWR production contract, filed a protest based on information made public by the Department of Justice as part of its ILL WIND investigation. Due to programmatic uncertainties resulting from the ILL WIND investigation and the Litton protest, the Air Force decided to convert the then ongoing B-1B/ARWR risk reduction contracts form the B-1B/ALR-56M specific studies to generic studies pending the outcome of the investigation.

While ARWR programmatic uncertainties resulted in impacts to the B-1B program during fiscal year 1989 and the first quarter of fiscal year 1990, more significant impacts to the B-1B/ARWR development were the result of specific congressional language adopted by the fiscal year 1990 Appropriations Conference. Specifically, Section 9071 of the Conference provided that "no funds available to the Department of Defense may be used for research, development, test, evaluation, installation, integration or procurement of an advanced radar warning receiver for the B-1B".

On December 8, 1989, the Department of Justice and Loral entered into a settlement which resolved all criminal and civil liability arising from the ILL WIND investigation. In addition, the Air Force and Loral agreed to significant contractual changes and implemented appropriate administrative remedies.

Absent Section 9071, neither the Litton protest or the DOJ investigation would have impacted the B-1B/ARWR program subsequent to the date of the overall settlement. These restrictions precluded the Air Force from completing its ongoing risk reduction activities and delayed the development and integration of the B-1B ARWR approximately one year. These efforts will be reinitiated in fiscal year 1991.

Question. What do you anticipate will be the total cost of this program?

Answer. It is estimated that the total program will cost $479 million.

SHORT RANGE ATTACK MISSILE TACTICAL (SRAM-T)

Question. The SRAM-T is the nuclear warhead which will be placed on the SRAM II missile. Recent problems with the SRAM II rocket motor have caused a slow down in the SRAM-T program as well.

To what extent have the SRAM II problems caused changes for the SRAM-T?

Answer. There have been no changes to the SRAM-T program. The first 18 months of the SRAM-T program are devoted to development and engineering tasks primarily directed towards integration of the DOE tactical warhead, the SRAM-T missile, and the F-15E aircraft. The rocket motor development problem is directly related to propellant cracking at very low temperatures. The rocket motor problem appears to be fixed; however, to protect against extended technical risk in this area, the SRAM-T program will not go beyond preliminary design review until the SRAM II rocket motor design has been proven and has completed critical design review.

Question. The fiscal year 1991 budget request for SRAM-T is $109.6 million for R&D. Does this request reflect the schedule slips?

Answer. $109.6 million was the fiscal year 1991 request in the fiscal year 1990 President's (PB). The fiscal year 1991 PB request is for $118.6 million; the increase added F-15E RDT&E funding for SRAM-T integration, which was removed from the F-15E progam element. There have been no schedule slips in major milestones from the program presented to Congress for the fiscal year 1990 budget request. The SRAM-T program awarded the full scale development contract to Boeing Aerospace and Electronics on April 3, 1990. Flight tests will begin in 1992, production in 1994 and the first assets will be delivered in the third quarter fiscal year 1995.

Question. Given the reluctance of the German's to allow stationing of the Army's Follow-on-to-Lance within their borders, what gives the Air Force assurance that the Europeans will accept SRAM-T missiles?

Answer. SRAM-T has a validated worldwide requirement to enhance the tactical nuclear capability of all the theater nuclear CINCs. Basing the F-15E in Germany, with SRAM-T, improves NATO nuclear deterrent posture. SRAM-T's development, however, does not depend solely on German acceptance. Twice in the last two months, Germany with other NATO members, has clearly endorsed continued nuclear deterrence through modernizing NATO dual capable aircraft and air launched nuclear weapons to ———. At NATO's High Level Group meeting in March, and the Nuclear Planning Group meeting in May, all NATO members reaffirmed the critical need or continued nuclear deterrence. ———. SRAM-T employed on U.S. F-15E and F-111 aircraft meets NATO's requirements.

ADVANCED MEDIUM RANGE AIR-TO-AIR MISSILE

Question. In fiscal year 1990, Congress reduced the AMRAAM program based on test failures and contractor schedule slips. Recent concerns with contractor performance after captive carry test failures identified continuing problems with the missile, the Air Force discontinued acceptance of operational missiles.

Current news reports indicate continuing problems for AMRAAM. What is the status of the testing program? Do you plan more tests and if so, will additional funds be required?

Answer. Additional free flight, captive carry, and ground testing is planned as outlined below. Funds required for these remaining tests are included in the current budget plan.

Free Flight Test: For full scale development, a total of 95 launches were completed. For Lot 1 missiles, a total of 33 launches have been completed. The overall success rate against targets is 76.1 percent, the highest for any air-to-air missile development program. This includes the toughest test a U.S. air-to-air missile has ever had to undergo—the 4v4 test where four AMRAAMs were launched from one F-15 within seconds of each other against four separate targets. These targets were at lower altitudes and used heavy electronic countermeasures against both the launch aircraft and the AMRAAMs. All four missiles scored kills against their respective targets (three direct hits and one within lethal range). Only two IOT&E launches remain in the AMRAAM test program.

Captive Testing: Stage 3 testing of the AMRAAM Captive Carry Reliability Program (CCRP) has currently accumulated more than 1300 captive flight hours with 11 confirmed failures and one recent anomaly which is in preliminary analysis. Seven of the failures occurred during the first 325 hours of Stage 3 testing, with the remaining 4 (5) occurring during the next 1000-hour interval. The Mean-Time-Between-Maintenance (MTBM) has increased 120 percent since these early failures (50 hours to 110 hours cumulative MTBM). These failures were primarily the result of poor vendor quality control. Based on the last 1000 hours of captive carry testing and ground vibration testing the MTBM projected for this point in the program has been met. The Follow-on captive carry evaluations, employing 42 missiles and totaling nearly 7,000 flight hours, on F-15, F-16, and F-18 aircraft are scheduled for the mid-1990 through 1992 time frame as originally planned. The outcomes of these CCRPs will evaluate the continuing overall system reliability growth.

Ground Testing: As a part of production Lots 2 and beyond a Production Reliability Acceptance Test (PRAT) will be conducted on a sample quantity of missiles. In addition to the PRAT, ground tests are being conducted to expedite reliability growth. These tests employ test-analyze-fix methodology to identify problem areas and as necessary introduce minor design and/or process changes into the production line to improve reliability.

Question. The fiscal year 1991 budget request includes $25.516 million in R&D funding for the AMRAAM P3I program. How will this funding be used?

Answer. Funding will be used to work a series of five P3I items, These are Electronic Counter-Countermeasures (ECCM), compressed carriage, advanced propulsion, test and integration, and continued studies. This is a Joint Air Force/Navy prioritized listing of those item required to: (a) allow the missile to grow as the threat changes or in the case of ECM to respond to threats which have evolved since the missile went into production, and (b) be compatible with new aircraft such as the ATF. The majority of the fiscal year 1991 P3I funds ($20.9 million) will be applied to the Navy's number one priority—ECCM and to the Air Force's number one priority—compressed carriage. Specifically, funding will: (1) Continue development of improvements to AMRAAM's ECCM capabilities. These improvements will enhance AMRAAM's ability to detect and track targets under evolving electronic combat environments. These improvements will be implemented through changes to the guidance section (radar hardware, digital processor and software). (2) Continue development of a compressed carriage configuration of AMRAAM. This configuration will allow a larger number of AMRAAMs to be carried in the internal bays of advanced fighter aircraft such as the Advanced Tactical Fighter (ATF). This will maximize the operational effectiveness of the fighter weapon system by improving exchange ratios. The wings and fins of the missile will be decreased in size, thereby reducing the carriage volume. Attendant guidance system changes will also be made. (3) Support an advanced propulsion system engineering study. This study will address a number of design and motor integration issues for P3I advanced propulsion requirements such as increased no escape zones for countering future threats. Additional risk reduction work will be undertaken subsequently to prepare for FSD of an advanced propulsion AMRAAM. (4) Support studies and analyses to perform the required system engineering efforts to prepare other P3I initiative areas for development. An example area is improved lethality, which includes warhead and fuze improvements.

Question. Why are upgrades needed if the basic missile does not work?

Answer. The basic missile does work and its performance has been unsurpassed. Of the numerous Joint Service Operational Requirements the missile is fully satisfactory on all of them with the exception of reliability. That includes ECCM, multiple target, all aspect attack capability, and so on. Recent concerns resulting from captive carry tests relate primarily to reliability. The AMRAAM program has recently been reviewed by three senior level teams from outside the program office. These review teams were specifically charged with reviewing all design, reliability, and contractual aspects of the program. The teams concluded that the AMRAAM design is sound and can be produced at reasonable cost with a resulting reliability that will grow to expected values. A formal corrective action and reliability improvement plan (as a part of the basic program) will provide the structure for resolution of reliability related problems. In addition, a recent 4v4 flight test (where all missiles scored kills against the respective targets) verified the missile's capability against multiple targets in a complex ECM environment. This was the most complicated test ever accomplished on an air-to-air missile. P3I upgrades are driven by threat evolution and advanced fighter integration requirements, not by basic system deficiencies. These upgrades require a development program that must begin now in order for them to be available to counter evolving threats.

Question. Budget justification material indicates there are "new projected threats" which need to be countered with AMRAAM. What are these threats and how valid are they in the current European environment?

Answer. The threats referred to are improvements in Soviet capabilities since the AMRAAM design was completed several years ago. Threat concerns stem primarily from two sources: (1) current and near term projected electronic countermeasures (ECM) environment in an air-to-air conflict, and (2) fielded and projected Soviet medium range air-to-air missiles. These capabilities can be employed in a variety of conflict scenarios and are not limited to any specific geographical area. The major threat to AMRAAM is expected to be ECM. A classified summation of this threat is detailed in the AMRAAM System Threat Assessment Report (STAR). An ECM Order of Precedence in the STAR addresses 31 current and projected ECM techniques of primary concern to the AMRAAM system. The P3I improvements will enhance AMRAAM's ability to operate in the electronic combat environment against these techniques. A significant counter threat to the use of the AMRAAM is the use of improved air-to-air missiles to attack the launch aircraft. ———. The P3I advanced propulsion initiative will keep the U.S. ahead of these developments.

Question. There have been press reports that funding for the On-Board Electronic Warfare Evaluation System (OBEWS) for AMRAAM training have been eliminated in the out years? Is this true?

Answer. The On-Board Electronic Warfare Simulator (OBEWS) does not provide AMRAAM training. OBEWS was carried within an AMRAAM type pod for demonstration and flight test at Eglin AFB. OBEWS provides a digital, multi-threat environment through the aircraft radar warning receiver, supplementing the outside environment, to train F-16 pilots.

Question. How much is included in the fiscal year 1991 budget request for OBEWS? What is the fiscal year 1990 funding level for OBEWS?

Answer. OBEWS is fully funded in PE 0604270F, EW development, Project 2272, F-16 Protective Systems. R&D (3600) funding for fiscal year 1990=$1 million; fiscal year 1991=$4.5 million. Productive funds (3010) are in PE 0207597F, Common ECM Equipment, available in fiscal year 1992.

SENSOR FUZED WEAPON

Question. The Sensor Fuzed Weapon (SFW) is air delivered munition which scatters anti-armor submunitions by parachute. The SFW program began in 1985 and has a history of test failures and performance problems. Additionally, both GAO and DoD IG have studied this program, reviewing among other things, the cost and operational effectiveness of the weapon. In 1989, the Air Force stopped testing SFW and restructured the program. Testing was restarted in July 1989.

Mr. Welch, in a February 26, 1990 letter to the Committee, Secretary Rice stated that the SFW program had breached its program acquisition unit cost by more than 15 percent.

What caused this cost increase?

Answer. Approximately half of the increase was due to the program's restructure, the other half was due to increase in the OSD inflation indices guidelines. Of the $667.6 million increase in total cost, $101.8 million is attributed to a one year slip in production start (from fiscal year 1991 to fiscal year 1992); $229.1 million is due to changes in acquisition strategy to include a Production Transition Program (PTP), lab and government analysis and moving competition to the fifth year of the production; $3.8 million is due to the data price increases and $332.9 million is a result of changes to the OSD inflation guidelines as of 15 December 1989.

Question. Exactly how much over its program acquisition unit cost is SFW?

Answer. In then year dollars, the SFW program acquisition unit cost (PAUC) increased from $.162 million to $.196 million, a 21 percent increase. In base year fiscal year 1979 dollars, the PAUC increased from $.079 million to $.084 million, a 6.3 percent increase.

Question. What is the procurement strategy for SFW?

Answer. The SFW will complete FSD in fiscal year 1991 and enter Low Rate Initial Production with Textron Defense Systems beginning in fiscal year 1992. After the Functional Configuration Audit (FCA) is completed in fiscal year 1991, a technical data package will be used to compete the SFW second source contract. A full and open competition will be used to select one second source contractor for a qualification and a test effort to be awarded to fiscal year 1992. This contract will include a low rate production option to be exercised in fiscal year 1994 after successful qualification. Competition for full rate production will be awarded to two contractors beginning with the fiscal year procurement.

Question. Last year the Air Force estimated that no R&D funding would be required for SFW in 1991. However, the fiscal year 1991 budget request includes $23.879 million for SFW. Why is this funding needed?

Answer. During of first part of fiscal year 1989, the program had several test failures. After several independent technical reviews, the program was restructured, and approved by SAF/AQ and USD(A)/Conventional Systems Committee in August and September 1989. We took the concurrency out of the program, and added some additional contractor testing, a Production Transition Program (PTP) to lower the risk of getting into production, and additional government analysis and support. With these additions, in fiscal year 1991 we will complete DT&E, Live Fire Test, continue IOT&E and continue PTP. The restructure is really paying off, since then, the DT&E program is 100 percent successful—14 for 14.

SHORT RANGE ATTACK MISSILE II (SRAM-II)

Question. The Air Force is continuing to experience problems with development of the rocket motor for the SRAM-II. Indications are that the problems have caused a 7-month slip in the schedule for first flight test. This is the second time the program has slipped since SRAM-II entered full scale development in 1987.

What problems are you experiencing in the tests of SRAM-II?

Answer. The major development problem has been propellant cracking in the second pulse during thermal cycles to −45 degrees F. To solve the problem, we completed a very extensive fault isolation tree analysis. The main cause has been isolated to be a chemical interaction between the propellant and the rubber barrier that separates Pulse 1 and Pulse 2. Thermal cycle tests are currently being conducted with a new barrier material added. The tests are not final, but results look very promising. The next lot of eight full size development motors will be built this summer and tested to confirm that the problem is resolved. Three of these motors will be used to build the first three flight test missiles. The flight test program, which started in November 1989, continues with no problems. Environmental and jettison missions are being flown and captive carry, software integration missions will begin soon. Only live launches have been delayed due to the development problem with the rocket motor propellant.

Question. Is this a contractor-quality problem or a design problem?

Answer. Neither. The rocket motor fault tree analysis looked at all possible causes, including contractor quality control. The propellant cracking was not the result of quality control deficiencies, nor rocket motor design. It was the result of an unforeseen chemical interaction between the propellant in pulse 2 and the barrier. This cracking was not found in initial laboratory samples and was only revealed by thermal tests on full size motors. The basic rocket motor case, propellant formulation, and grain design are sound.

Question. What impact have these problems had on the Air Force's SRAM-T program?

Answer. None. Neither the SRAM-T program schedule nor missile design have been impacted. The first 18 months of the SRAM-T program engineers the integration between the tactical warhead from DOE, the SRAM missile, and the F-15E aircraft. SRAM II rocket motor development problems are directly related to propellant cracking in Pulse 2, at very low temperatures. This temperature requirement is needed for the SAC missiles which will be fielded for 15 years at cold northern tier bases. The rocket motor problem appears to have been fixed and is not directly related to the SRAM-T. To protect against extended technical risk in this area, the SRAM-T program will not go beyond preliminary design review until the SRAM II rocket motor has been proven fixed and has completed critical design review. This links the SRAM-T very closely to the SRAM II but does not delay the SRAM-T program.

MK XV PROGRAM

Question. The MK XV is not included in the fiscal year 1991 budget request, but there are indications that the Department would like to put it back in the budget. The MK XV is a Identification-Friend-Or Foe (IFF) system requested by NMATO participants. Is this true?

Answer. The MK XV is the US implementation of the NATO Identification System (NIS) Question and Answer (Q&A) component. Italy is participating with the US in the MK XV Full Scale Development phase. France, Federal Republic of Germany, and the United Kingdom will procure their own interoperable version of the NIS Q&A. Other nations will procure from US, ROF, UK, FRG, and IT. A March 1990 decision to continue the program has left a gap in fiscal year 1991 which the OSD is determining how to fund.

Question. If so, how do you plan to submit this request to Congress?

Answer. OSD is still determining how to fund MK XV in fiscal year 1991.

Question. What level of funding will be required in fiscal year 1991?

Answer. MK XV core (AF-led) will require $100 million (AF) in fiscal year 1991.

Question. Justification material submitted with the fiscal year 1991 budget request indicates that the Air Force plans to reprogram $53 million cut out of the Combat ID line in 1990. "Combat ID" is the funding source for Mark XV. What is the Air Force's commitment to Mark XV if you are planning to reprogram money out of this program?

Answer. The $53 million was assigned to a Congressional Undistributed Reduction before a decision was made to re-evaluate cancellation of the program. However, after further review by OSD, a March 1990 decision was made to continue MK XV. OSD is still determining how to fund fiscal year 1990/91.

Question. When will the allies commit to the purchase of the Mark XV system. What has been the interest in other Combat ID systems and has this interest materialized in a procurement of these systems?

Answer. ROF, FRG, and UK will obtain full scale development authorization in July 1990. NATO investment to date is $200 million. NATO FSD budget is $700 million. Italy is participating in the US MK XV FSD phase. Procurement funding is contingent on the results of FSD just like the US acquisition process; therefore, an exact date for commitment to purchase is difficult to predict. The other NATO countries' budget status is being requested. ———.

Question. The Air Force is in the process of executing a mid-life modification program on F-16s owned by Belgium, Denmark, The Netherlands, Norway, and the United States. As part of this modification, will the Air Force make the aircraft Mark XV-capable? If not, why?

Answer. F-16 Air Defense Fighter (270 Block 15 aircraft) has MK XII Combined Interrogator/Transponder (CIT). F-16 mid-life modification program will get MK XII CIT which has a growth provision to MK XV capability.

NATIONAL AEROSPACE PLANE

Question. Last year, the Air Force projected a $389.5 million requirement for fiscal year 1991. The 1991 budget submitted to Congress includes only a $158 million requirement for fiscal year 1991. Why did your cost estimate decline by $231.5 million?

Answer. The program was reviewed by the National Space Council in June 1989. In July 1989, the President approved the National Space Council's recommendation that, to better balance cost and schedule risk, the technology development phase of the program be extended two and one-half years. This program rephasing caused the change in the funding profile referenced above as fiscal year 1991 is now dedicated solely to continued technology development efforts as opposed to the construction of the X-30. The Air Force fully supports the rephased program and, along with NASA, has NASP funded at the level necessary to execute the program.

Question. In its Annual Report for Fiscal Year 1989, the RAND Corporation states that based on their analysis, the NASP program is extremely ambitious, highly concurrent, and will not provide substantially reduced launch costs. What is your assessment of the RAND Corporation's analysis?

Answer. The NASP program is highly ambitious. We are addressing the potential for an advance in transportation as great as the turbine engine was over the piston engine. The RAND report is based on the program as it existed before the National Space Council review of the program. The program rephasing removed much of the concurrency from the program. However, as a science and technology program, NASP will always have some risk (ambition) and concurrency. NASP will not reduce launch costs as it is an experimental aircraft which is intended to open up the hypersonic flight regime and demonstrate the enabling technologies for future operational vehicles. Our analyses show that these future vehicles have the potential to reduce payload-to-orbit costs by an order of magnitude or more.

The RAND report assumes a large fleet of expensive vehicles, an extremely low flight rate, and a short lifetime (50 flights per vehicle lifetime) thereby driving the costs per flight up to levels comparable to rocket systems. Our analyses indicate that, as compared to the RAND report, a smaller fleet of vehicles, higher flight rates and a longer lifetime may be feasible.

Question. Additionally, the RAND Corporation states that while significant progress has been made on some of the NASP technology, much remains to be proven. RAND recommends that the United States continue to develop the NASP technology at a slower pace than currently planned. What is your assessment of the RAND Corporation analysis?

Answer. The RAND Corporation recommendations predate the NASP program rephasing. The effect of the rephasing is essentially the same as the RAND suggestions.

Question. When will the NASP production decision be made?

Answer. The NASP will not enter full scale development or production. The NASP program is intended to develop critical technologies and demonstrate them in order to establish the foundation for an entirely new generation of flight vehicles. To that end, two X-30 research vehicles will be designed, built, and flight tested. The decision on whether or not to build these research vehicles will be made in early 1993. They are intended to fly in approximately fiscal year 1997. Assuming NASP is successful, a decision could be made in the late nineties to enter full scale development (and eventually, production) on follow-on systems. Studies indicate a variety of NASP-derived vehicles might be developed to fulfill both military and civil requirements.

Question. What is the current and future role of the Air Force in the NASP program?

Answer. The Air Force is the executive service for the NASP program and manages the program through a Joint Program Office (JPO) at Wright-Patterson Air Force Base. The JPO is led by an Air Force Program Manager with Navy and NASA deputies. The Air Force is also one of the five agencies (four DoD plus NASA) represented on the Steering Group for the program. (The other DoD participants are the Navy, SDIO and DARPA). Top-level guidance for the program comes from this Steering Group which is jointly chaired by DoD and NASA representatives. The Air Force has established a jointly staffed NASP Interagency Office (NIO) within the Air Force Secretariat. The NIO is headed by an Air Force Director with a NASA Principal Deputy and joint Navy, Air Force and NASA staffing. The role described for the Air Force is expected to continue for the remainder of the program.

DIRECT AIRFIELD ATTACK COMBINED MUNITION (DAACM)

Question. The DAACM is designed to be dropped by parachute from low-flying aircraft onto Warsaw Pact runways and blast holes in the concrete. In fiscal year 1990, the Congress eliminated the funding for the system due to a restructuring of the program by the Air Force. The fiscal year 1991 budget request includes $10 million to start this program up again next year.

Why are you requesting funds for a program which was cancelled by the Congress just a few months ago?

Answer. The Air Force deferred DAACM Full Scale Development following an Airfield Attack Review conducted in June 1989. Upon reviewing the worldwide improved threat runway—validated by the Defense and Air Force Intelligence Agencies—Air Force leadership directed immediate cancellation of the Full Scale Development solicitation. They also directed testing of the Bomb, Kinetic Energy Penetrator (BKEP), Durandal and alternative airfield defeat concepts; and a results briefing to SAF/AQ. Subsequently, the Appropriations Conference zeroed the fiscal year 1990 request ($17.0 million, 3600) and accompanying language directed the Air Force to brief the Committees on the improved threat runway, conduct tests of alternative concepts, and report test results. These tests were completed on 6 April 1990. Data reduction/analysis is underway and concept selection will occur in July 1990.

Question. What will the funds be used for?

Answer. Fiscal year 1991 request funds first year of Full Scale Development for an Airfield Attack Munition (AAM) capable of defeating the improved worldwide Attack threat. This program is being undertaken in response to a documented Tactical Air Forces Statement-of-Need (TAF SON 306–79, Airfield Attack, revalidated in November 1988).

Question. System capability problems have been identified by the General Accounting Office. One problem identified last year was the fact that Warsaw Pact runways were being overlayed and that this action created a runway of greater thickness than could be penetrated by the DAACM. Have you addressed this issue?

Answer. As stated above, DIA and AFIA identified the threat change. The subsequent GAO audit October 1989 concurred with the Air Force approach of testing DAACM submunitions and alternative concepts against the improved threat. These tests have been completed and data reduction/analysis is in progress.

Question. Has DoD military-wide munitions purchase guidance been revised to reflect changes in Europe and concentrate on Third World contingencies, with an emphasis on systems which cover a greater spectrum of targets, rather than a specialized "runway buster"? If so, how does DAACM fit into this revised guidance?

Answer. The AAM will be capable of defeating a broad range of targets from the original NATO standard runway of 12 inches to projected threat runways in excess of 30 inches (2005 and beyond). We are also exploring alternative concepts which would provide the capability to destroy other airfield targets.

Question. The fiscal year 1990 Congressional reduction eliminated funding for this program. Why does your budget justification material show a $1 million program in fiscal year 1990?

Answer. Based on Air Force and Congressional direction to conduct tests against the improved threat, the Air Force accomplished a below-threshold reprogramming action within the Armament/Ordnance Development Program Element (PE 060402F, Line 127). Remaining fiscal year 1989 funds were also used in conducting the directed test program.

CLOSE AIR SUPPORT

Question. The fiscal year 1991 budget includes a total $47.3 million for Close Air Support (CAS) program which includes modifications to F–16s and A–10s. When complete, the modifications and research CAS efforts will total over $1 billion.

Mr. Welch, please tell us about your plans for both research and eventually procurement for the CAS mission.

Answer. The fiscal year 1991 budget contains RDT&E funds for several CAS/Battlefield Air Interdiction (BAI) programs. These include modification programs for A–10s and F–16s to enhance their capability in CAS and BAI. In addition, a program to evaluate and develop specific night systems, for retrofit or production installation for CAS/BAI aircraft is funded. Procurement follows in the out-years for these efforts which started in fiscal year 1990. The Defense Acquisition Board meets this summer to review CAS/BAI follow-on aircraft alternatives. Funding requests for this follow-on aircraft will await a DAB decision.

Question. Why is there no fiscal year 1991 request for the A-7F CAS upgrade? How will the CAS mission be accomplished by the Air Guard and Reserve without pursuing the A-7F upgrade.

Answer. There is no fiscal year 1991 funding request for the A-7F because the YA-7F prototype test program completes in fiscal year 1990. The Air Force dedicates approximately 25 percent of its fighter force (to include the ANG/AFRES) to CAS/BAI. All aircraft capable of ground attack, including F-16s, can be used in CAS/BAI. If the A-7F is not procured, then ANG units (no AFRES units have the A-7) dedicated to CAS/BAI will be equipped and trained to do so.

Question. Given fiscal realities, has the Air Force considered modifications to F-16s rather than procurement of new aircraft?

Answer. Yes. There are extensive modifications planned for some older F-16s to improve their capability in the CAS/BAI mission, and that is contained in the fiscal year 1991 request. The fiscal year 1991 request contains no funding for new production aircraft to perform the CAS/BAI mission.

Question. Considering the CAS provided by the F-117A, what is the rationale for pursuing a $1 billion program to enhance the mission capabilities of these older systems.

Answer. The use of the F-117A in Panama does not qualify as a typical CAS mission. It was an interdiction mission, with carefully preplanned targets, and did not involve the expenditure of ordnance in close proximity to friendly forces. Although all ground attack aircraft could be called upon to provide CAS or BAI, some are better than others, depending on the situation. The limited quantities of the F-117A alone makes its use, in a classic CAS/BAI scenario, unlikely.

A-7 UPGRADES

Question. The Air Force and the Congress have invested $163 million in developing the "A-7 Plus" aircraft which is intended to modernize Guard and Reserve units at about half the cost of new F-16s. Mr. Welch, what is the status of the A-7 Plus development program?

Answer. Two YA-7F prototype aircraft have been developed and both are now flying at Edwards AFB in flight testing. The purpose of these tests is to evaluate the performance of the A-7F configuration, which includes a new augmented engine and aerodynamic changes to the A-7D. As of May 4, a total of 56 test flights have been flown accumulating 112.4 hours. All program objectives are being met and the flight test program is on schedule with completion planned for September.

Question. What caused the 6 month schedule slip?

Answer. The planned first flight for the first prototype was in May 1989. The first flight did not occur until November 1989. The prime contractor had difficulty meeting the schedule due to engineering problems and vendor delays. Additional delays occurred when structural concerns about the A-7 fleet, as a result of wing cracks discovered in some aircraft, required an extensive and time-consuming inspection of all critical elements in the wings.

Question. No R&D is requested in fiscal year 1991 for A-7 Plus. Unfortunately no procurement is requested either. Are we just building expensive museum pieces?

Answer. No R&D for the YA-7F is requested for fiscal year 1991 because the program completes in fiscal year 1990. Procurement for the A-7F is not contained in the fiscal year 1991 budget because a production decision has not been made. The Defense Acquisition Board (DAB) is reviewing all alternative CAS/BAI aircraft in a Milestone IV review this summer. The A-7F is one of those aircraft under review. A decision to proceed with A-7F production, and request procurement funding will await the outcome of the DAB review.

Question. If the A-7 Plus dies a quiet death, do you then plan to give new F-16s to the Guard and Reserve to replace their ancient A-7s?

Answer. If it is decided not to proceed with the A-7F, it is planned for the A-7D to be retired from the Air National Guard (there are no A-7s in the Air Force Reserve). These A-7Ds will be replaced with other aircraft and, in most cases, by F-16s currently used by the active force.

JSTARS PROGRAM

Question. The fiscal year 1991 budget contains $232 million to continue development of JSTARS, up significantly from the $88 million appropriated last year. Mr. Welch, the Committee understands the Air Force hit a snag in this program last year and restructured it. Explain the current JSTARS acquisition strategy with used commercial 707 aircraft rather than new aircraft.

Answer. The Defense Acquisition Board (DAB) met in October 1989 and approved the Air Force position to proceed with used 707 aircraft as the production aircraft for Joint STARS. Used 707-300 (cargo version) aircraft will be purchased from the open market. These aircraft will be refurbished before beginning the production modification process, resulting in a final production aircraft, E-8C, configuration.

Question. The JSTARS concept was conceived with the European armor threat in mind. Given recent world events, they may be less of a threat today. Is JSTARS still needed?

Answer. The joint operational requirement for Joint STARS is for a worldwided deployable system. This worldwide requirement is found in the Joint System Operational Requirements Document (JSORD) dated October 1989, which was validated by the Joint Requirements Oversight Council (JROC) in December 1989. Specific operational requirements, outside Europe, for Joint STARS were identified by Central Command, Southern Command, and Special Operations Command.

Question. Secretary Cheney is doing a Major Aircraft Review (e.g., ATA and ATF) due to the perceived lessened threat in Europe. Is the JSTARS program under such a review? If not, if Congress were to require one, how much could be reduced from your fiscal year 1991 budget request due to the program delay inherent in conducting such a review?

Answer. Joint STARS is not currently under any type of major aircraft review. A part of the October 1989 DAB involved a review of the JSORD by all CINCs before the JSORD was validated by the JROC. The JSORD is currently undergoing revision and should be available late this year. If the fiscal year 1991 funding was reduced in anticipation of a major review and its possible outcomes, impacts to the program will occur in the test schedule, production schedule, and the Initial Operational Capability (IOC) for Joint STARS. A further delay of the Joint STARS IOC will result in impacts to the support of the Army Tactical Missile System (ATACMS) IOC.

Question. Do you think such a review would be useful to the Secretary of Defense or the Congress?

Answer. Joint STARS went through a vigorous review process in September and October 1989 in Preparation for a Defense Acquisition Board (DAB) review 31 on October 1989. The process leading to the DAB included reviews by the Air Force Council and the Air Force Board and a Joint Requirements Oversight Committee (JROC) review by the JCS. The JROC validated the worldwide requirement for Joint STARS and the requirement was validated by all the CINCs. The Joint STARS Joint Systems Operational Requirements Document (JSORD) is currently under revision to reflect recent changes in worldwide requirements. Since Joint STARS currently has verified worldwide requirements a review at this time may not be helpful.

Question. What is the total development cost and total production cost of this program, and how much more funding will be required after fiscal year 1991?

Answer. The program funding requirements identified at the October 1989 DAB were development cost of $2542 million and production costs of $4256 million. The fiscal year 1991 President's Budget reflected these requirements for fiscal year 1991 only. The funding required for the restructured program from fiscal year 1992 and out are identified in the POM. The amount of funding required after fiscal year 1991 cannot be specified until the POM is released outside OSD.

Question. For the record, compare the Joint STARS budgets in each fiscal year, 1989 to 1991, to current contracts at target value, and explain any differences in detail.

Answer.

[In millions of dollars]

	Fiscal year—			Total
	1989	1990	1991	
PE 64770F (Joint STARS development):				
President's budget	232.1	88.1	232.5	550.7
Subsequent year financing	81.9			81.9
Other Sources (GPS integration)	2.0	5.1		7.1
Reprogramming	−2.0			
PE 64270F (Joint STARS self defense suite):				
President's budget		11.5	27.7	42.7

	Fiscal year—			Total
	1989	1990	1991	
Reprogramming		−2.5		
Program office funding, total	314.0	102.2	260.2	676.4
Uses:				
All contract (LOGO-Non-LOGO/Planned)	177.3	107.7	200.4	485.4
Non-contract (SDS/Test/SPO/Ops/GFE)	56.0	67.7	67.3	191.0
Total	233.3	175.4	267.7	676.4

ADVANCED LAUNCH SYSTEM

Question. When Secretary Aldridge was in office, the Air Force was keen on the need to develop an Advanced Launch System with the goal of significantly reducing space launch costs. Now that he has left, interest in this program has apparently wanted.

Mr. Welch, explain the Air Force's current strategy for the Advanced Launch System and what has changed from the original concept.

Answer. The strategy for the Advanced Launch System (ALS) has not changed. It has only been delayed. The ALS program is committed to a new family of launch vehicles to provide responsive, reliable, flexible, low cost access to space across the broad range of expected payload sizes, orbits and launch rates for the operational command. The ALS is striving to develop the launch vehicle technology for a routine, operational capability while lowering launch costs from $3400/lb and being more responsive (quick turn-around) and resilient (recovery from failure).

Question. When could we actually field an advanced launch system under your new plan?

Answer. The Air Force is currently looking at the overall expendable launch vehicle fleet and satellite programs in defining the best time to bring the Advanced Launch System family into full scale development. Currently, due to budgetary constraints, the Air Force has moved the Initial Launch Capability (ILC) past the end of the century. But if other national requirements dictate, one member of the ALS family could reach ILC by the year 2000 with the appropriate funding.

Question. The fiscal year 1991 budget contains $60 million to continue work on ALS. Given your apparent disinterest in pursuing a robust program, why should Congress provide any funds at all?

Answer. This number reflects only the Air Force contribution. The DoD funding is actually $85 million. The Advanced Launch System propulsion development is the "long pole" in expendable launch vehicle (ELV) development. While the program will not enter full scale development to meet fiscal year 1998 deployment, the plan is still to bring on the next generation expendable launch vehicle soon after the year 2000. The nation and the DoD need the next generation launch vehicle to drastically reduce the cost of launch while increasing reliability, responsiveness and operability. The critical path for developing a new ELV is the propulsion development that will take seven years before the first prototype engine firing in fiscal year 1997. To make this ambitious schedule will not only take the funding from the Air Force, but also planned contributions to the Joint Program Office from NASA and SDIO. The spinoffs of the developments that we will accomplish during fiscal year 1990 and fiscal year 1991 can be applied to the existing ELV fleet. An example is the electromechanical actuators planned but not fielded for incorporation into the Titan IV to increase reliability and reduce processing times. A reason to continue funding is to maintain the core group of individuals knowledgeable on rocket propulsion and space launch so we can realize their full potential.

C-17 PROGRAM

Question. Last year the Air Force recognized that the C-17 development contract would greatly overrun its target value by about $600 million, and therefore significantly increased its funding estimates accordingly.

How far behind the original schedule is the program currently?

Answer. All activities are proceeding on time or ahead of the revised schedule in support of a first flight date no later than June 1991. This date, previously scheduled from August 1990, was revised due to problems with the Mission Computer and Electronic Flight Control System development. Although further development and production delays are always possible to some extent, there is no indication of any further problems that would cause a delay in achieving first flight by June 1991.

Question. What is your current estimate of the additional "overtarget" cost growth?

Answer. The fiscal year 1991-94 budget submission funds the prime contract which includes the FSED, Lot 1, and Lot II efforts for $778 million above target price. The contract ceiling compared to this budget indicates that the C-17 contract has a remaining "over target" cost risk of $115 million. This amount is being evaluated as part of the upcoming fiscal year 1992-97 POM process.

Question. Last year the Air Force forecast needing $504 million for C-17 R&D in fiscal year 1991, which included a large increase for the overtarget problem. The current budget requests $541 million, which is even higher. Is there a new problem?

Answer. There is no new problem for the C-17 R&D fiscal year 1991 budget. during fiscal year 1990, $30 million was cut from the program with a fiscal year 1991 restoration. In addition, OSD inflation price projections changed with increased the fiscal year 1991 request by $9 million. Subsequent to the inflation changes, the fiscal year 1991 program had three other miscellaneous Program Budget Decisions (PDBs) with cuts totalling $2 million.

Question. What is the additional $37 million for?

Answer. The net of the fiscal year 1990 cut payback, inflation increase, and the PBD cuts equal the $37 million fiscal year 1991 increase.

Question. Describe the status of the C-17 weight problem. Is it solved, and how many production aircraft will be delivered in an overweight condition?

Answer. Weight is not a requirement, performance is. The contractor has the responsibility and design flexibility to meet performance. All aircraft are expected to exceed the MAC performance thresholds and current projections support that.

Question. For the record, compare the C-17 RDT&E contract values in each fiscal year 1989 to 1994 to the budget. Use the contract value at target that existed on April 15, 1990 and explain differences in detail, particularly the "other government costs" category. Be definitive about ECO allowances.

Answer. C-17 RDT&E Budget:

[In millions of dollars]

	Fiscal year—					
	1989	1990	1991	1992	1993	1994
Budget (Dec 1989 SAR) [1]	933.8	917.0	546.1	475.5	132.2	14.1
Contract amount [2]	878.7	799.6	440.7	385.3	91.8	0
OGC	55.1	117.4	105.9	90.3	40.4	14.1
Test	(7.0)	(12.5)	(14.2)	(35.4)	(17.7)	(9.6)
Trng (incl sim)	(38.5)	(79.3)	(31.4)	(3.7)	(.2)	0
GFE	(.9)	(1.4)	(.2)	0	0	0
Mission supt	(8.7)	(23.8)	(21.4)	(15.8)	(12.7)	(4.3)
ECO	0	0	(26.7)	(21.5)	(9.6)	0
Other (site act/data)	0	(.4)	(12.0)	(13.9)	(.2)	(.2)

[1] Includes budget from PE 64227F, Flight Simulators.

[2] This amount includes the original contract target as adjusted for overtarget requirements that have evolved to date. The time phasing is based on the latest agreed-to limit of government obligation (LOGO) requirement. Thus, there is no discreet identification of target price by fiscal year.

TECHNOLOGY BASE

Question. Many in Congress have been concerned about the decline in funding in the Defense Technology base: programs involving basic research and science. How much is requested in fiscal year 1991 for Air Force technology base programs, and how does this compare to last year's level?

Answer.

Fiscal year 1991 request:	
Research (6.1)	$201.5
Exploratory development (6.2)	580.1
Tech base (6.1 & 6.2) (millions)	781.6
S&T (6.1, 6.2, 6.3A & NASP) (millions)	1,427.6
S&T (6.1, 6.2, 6.3A W/O NASP) (millions)	1,269.6
Fiscal year 1990 appropriation:	
Research (6.1)	195.2
Exploratory development (6.2)	582.5
Tech base (6.1, 6.2) (millions)	777.7
S&T [1] (6.1, 6.2, 6.3A & NASP) (millions)	1,439.5
S&T [1] (6.1, 6.2, 6.3A W/O NASP) (millions)	1,245.5

[1] Excludes SOF MFP 11 Funding; in FY 91 and beyond, SOF MFP 11 funds are appropriated directly to US Special Operation Command.

Question. What goals does the Air Force have for annual growth in the technology base programs?

Answer. The Air Force has a corporate commitment to fund the Science & Technology (S&T) program (6.1, 6.2, 6.3A W/O NASP) at 1.5% of Air Force Total Obligational Authority (TOA).[1] Technology base program elements receive approximately 50–55% of total S&T funding.

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[1] Actual formula #S&T−NASP/TOA−NFIP=1.5%

Question. What areas of research do you plan to emphasize in this and in the next few fiscal years?

Answer. The Air Force has an investment strategy for research that addresses the total range of Air Force mission needs. To maintain a balanced technology program, we conduct research in a number of technology areas and within these areas there are certain key technologies that could make a significant difference in future Air Force warfighting capabilities. Several of these important technologies have been identified in the *DOD Critical Technologies Plan*. In addition to these "critical technologies", the Air Force will be investing in computer-aided training and maintenance, detection of low observable air vehicles, hypersonics, spacecraft autonomy, pollution prevention and environmental restoration. This is not a complete list of technologies being pursued by the Air Force, but it does represent those that we believe are important to future combat capability requirements.

Question. Congress tends to focus on weapon system programs, so we don't discuss the technology base very often. What recent achievements has the Air Force had with the annual funding in this area?

Answer. Because of the long lead time from the technology base development to actual system application, it is difficult to specifically identify highly visible accomplishments as they mature in the technology base. However, many notable accomplishments can be traced to our technology base programs. They include such things as fly-by-wire flight control systems, carbon-carbon composites, lasers, turbine engines, and guided weapons. The Air Force technology base program has been very productive. We remain a technologically superior Air Force in large part because of technology base investments made in the past. Continued stable funding of the technology base programs will ensure a technologically superior warfighting capability for the Air Force in the future.

STRATEGY UNDERLYING WEAPONS DEVELOPMENT

Question. Recent events in Europe may have profound effects on U.S. military strategy. How do recent events affect Air Force Strategy?

Answer. Air Force strategy is part of the overarching U.S. military strategy as set forth in the National Military Strategy of the United States. As the political climate changes in Europe, continued military presence, at substantially lower levels, remains both militarily prudent and politically desireable. Key to that strategy is increased emphasis on stability and national sovereignty, in which the U.S. Air Force view toward global power through airpower's flexible global reach. Air defense; credible, flexible forces; and maintenance of the balance of military power on the Eurasian landmass are basic elements of our strategy for Europe. To this end the Air Force is structuring its force for a reduced Soviet threat environment.

Question. What efforts are on-going to redefine and update the Air Force's strategy?

Answer. The Air Force recently revised the Air Force Planning Systems to align with the revamped Joint Strategic Planning Systems. Concurrently with the initiation of the Joint Strategy Review, the Air Force has begun its Air Force Strategy review which augments the Air Force's planning system cycle for the fiscal year 1994-1999 POM. Working in tandem, the Joint and Air Force processes will result in a redefinition and update of the Air Force's strategy.

Question. How do these actions affect the requirements for a development of Air Force weapon systems?

Answer. Currently, the new Air Force Planning System is undertaking the task to provide Air Force Executive Guidance and the Air Force Plan to provide a macro prioritization of the needs of the Air Force. These documents will provide the framework from which requirements for Air Force programs will be measured.

NATIONAL AIRSPACE SYSTEM

Question. The fiscal year 1991 budget requests $35 million for a new start program that will cost over $350 million to develop to modernize the DOD air traffic control system. Mr. Welch, please explain the requirement to modernize the DOD Air Traffic Control System?

Answer. The DOD provides air traffic control services for approximately 22 percent of all air traffic. The DOD must remain interoperable with the FAA to ensure aircraft can safely transition through DOD controlled airspace. Additionally, NAS provides systems and facilities compatible with the FAA, prevents flight delays/cancellations, continues DOD's access to Special Use Airspace, provides transparent services to military and civil aircraft, maintains a trained cadre of air traffic control personnel, reduces DOD manpower and maintenance requirements, replaces aging DOD systems, and increases flight safety.

Question. Why is this important to start now?

Answer. The current FAA modernization program has been ongoing for several years. To obtain maximum cost efficiency through synchronization with the FAA, DOD efforts must begin now. Of particular concern is the acquisition of software for the Advanced Automation System to support DOD requirements. DOD must acquire software early in the FAA's acquisition process to prevent duplication of testing. Duplication of testing will significantly increase RDT&E funding for NAS.

Question. The Committee understands that this will be done in parallel with the FAA's modernization of the commercial system. How does DOD plan to take advantage of FAA's funded radar development and equipment programs?

Answer. The DOD NAS program is planning to take maximum advantage of the ongoing FAA development. Wherever possible, DOD procurements will be made on FAA contracts. In the case of the Airport Surveillance Radar, current planning indicates this will be a common unit for both DOD and FAA applications. Other NAS equipment configurations will be as close to FAA versions as possible while satisfying DOD requirements. For example, the automated data processors for the Advanced Automation System will be common with the FAA's program. Software modifications will address DOD unique requirements and interfaces.

Question. Why is any DOD RDT&E funding necessary?

Answer. Initial RDT&E funding will be used to perform cost tradeoff analyses to determine the most effective methods of implementing the NAS program. The majority of RDT&E funds support software testing for the Advanced Automation System and systems engineering for integration with a wide range of FAA air traffic control facilities. As part of the NAS program, DOD will improve the way it manages Special Use Airspace through the development of the Military Airspace Management System (MAMS). This development effort, estimated at $25 million, will increase efficient use of Special Use Airspace and allow greater use by commercial traffic.

Question. When will the new system be completely fielded?

Answer. The DOD NAS program is tied to the FAA implementation schedule, with a current planned transition period from 1996–2002 and a final operational capability in 2003.

B-1B AS A CRUISE MISSILE CARRIER

Question. The fiscal year 1990 Appropriations Act requires the Air Force to spend $50 million of 1989 RDT&E funds to complete testing of the B-1B as a cruise missile carrier.

Mr. Welch, we understand that the Air Force is balking at this requirement. Why?

Answer. The B-1B was designed as a penetrating bomber and is capable of doing so through the 1990's. Currently there is no operational requirement to carry cruise missiles on the B-1B and testing accomplished now would have to be redone when lead-time away from an operational requirement. Therefore, in order to maximize the benefits of an Advanced Cruise Missile testing program, the tests will be delayed until leadtime away from the requirement to carry cruise missiles.

Question. Is it your intent to comply with the law in this regard?

Answer. Of course, the Air Force always intends to comply with the law. In this case, we believe Congress fenced the $50 million thinking it would provide sufficient funds to complete Advanced Cruise Missile testing. However, in order to complete this testing an additional $92 million would be required which is not currently funded. When lead-time away from an operational requirement, we will seek the necessary funds to cost-effectively accomplish Advanced Cruise Missile testing.

Question. How much of the B-1B's $20.5 billion constant dollar ($28 billion real dollar) cost is due to meeting the Armed Services Committee's requirement to have such a capability in the baseline aircraft that is deployed today?

Answer. First, it is important to understand that the capability has been incorporated into the aircraft and can be tested when lead-time away from an operational requirement. Additionally, the initial requirement was for the B-1B to be able to carry the Air Launched Cruise Missile (ALCM). Due to vibration and acoustic levels experienced on external stations, the Advanced Cruise Missile (ACM) was substituted for the ALCM. The total acquisition cost for this capability was approximately $800 million. Both the ALCM and ACM have been carried on the B–1B and the ALCM has completed all internal carriage testing.

Question. Since we have invested such a large amount in this capability, why not do the tests while the B–1B and Advanced Cruise Missile test programs and organizations are still intact?

Answer. The desire to provide Advanced Cruise Missile capability, when needed, at the least cost, has led us to a delay in the completion of testing. The estimated $142 million required to complete cruise missile testing would include many tests which may have to be reaccomplished when the capability is fielded. Normal evolution of aircraft software and possible hardware modifications may negate the results of previous testing and necessitate further testing prior to fielding the system. For example, SRAM II upgrades will result in a new memory computer and software which would require retesting some elements of the Advanced Cruise Missile on the B–1B. These additional tests and associated costs can be avoided by commencing Advanced Cruise Missile testing lead-time away from the requirement.

Question. If left to your own schedule, when would you provide such a capability to the B–1B?

Answer. It is our intention to complete testing of the Advanced Cruise Missile on the B–1B in sufficient time to field the capability to meet a specific operational requirement. It is impossible to provide you with a firm date when this capability will be required, since it is dependent on many variables which must be constantly analyzed to determine our enemies' capabilities and intentions. The result of these analyses must be tempered with the structure of our own forces to arrive at an optimum defense posture.

Question. Our recent supplemental bill proposes to rescind these funds because the Air Force has not taken any action to comply with the law, yet the funds expire in less than 6 months. Do you agree with our view that the FY 1989 R&D funds we provided for this purpose cannot now be used with the little time remaining?

Answer. The program office had a plan for the expenditure of these funds to accomplish B–1B "baseline" activities which could still be accomplished if the funds were no longer fenced. Even at the time the funds were fenced, it was doubtful that all of the funds could be used for Advanced Cruise Missile testing and related activities. The program office estimated that $19 million of the funds could have been used for ACM testing and that an additional $18 million could have been used for related activities. However, $13 million of the funds could not be used and was likely to expire on September 30, 1990, as a result of the fence.

Question. Isn't it true that the ACM was designed specifically for external carriage on the B–1B aircraft?

Answer. No, that is not correct. The ACM was designed for operation on both the B–52H and B–1B. Because the B–1B has no current operational requirement as a cruise missile carrier, further testing is being deferred until lead-time away from an operational requirement.

[CLERK'S NOTE.—End of questions submitted for the record.]

THURSDAY, MARCH 29, 1990.

RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES—DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

WITNESS

CRAIG I. FIELDS, DIRECTOR, DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

INTRODUCTION

Mr. **MURTHA**. The Committee will come to order. Today the Committee will hear testimony on the Defense Advanced Projects Research Agency (DARPA) RDT&E budget request in fiscal year 1991 for $1.078 billion. DARPA has a very exciting mission of performing high risk research that has high potential payoff for the military services. DARPA also has an excellent track record of delivering high quality, innovative products. The Committee is pleased to welcome back Dr. Craig Fields, who is in his second year as the DARPA director. Today's hearing will be closed due to the classified material to be discussed.

We are excited about your mission and we hope that we will be able to keep it adequately funded. I have said to a number of different people who are interested in defense we are going to have to cut manpower, we are going to have to cut back on some of our strategic modernization, but we certainly don't want to cut back on research.

We want to continue at a level where it keeps us abreast of what is going on.

I want to apologize for having to change the schedule. Dick Schulze's wife, who you may have known, died a couple of months ago and they had a funeral at the time, but it was during the recess, so none of us had a chance to go. They had a nice memorial service at the Capitol Hill Club and it was a touching service for a great lady. It was a small inconvenience for us to delay today's hearing, but it was a very significant service, and we appreciate your accommodating us.

If you will put your full statement in the record and briefly summarize it, we will get right to the questions.

SUMMARY STATEMENT OF DR. FIELDS

Dr. **FIELDS**. Thank you, Mr. Chairman.

I would like to put the full statement in the record and take five minutes to raise what I consider the five main points that we are going to make in the testimony and then spend a few minutes going over some of the things we have brought this morning. I felt that since you are paying for all this technology, occasionally you should see some of it. None of the things we brought are models. They are real things. Then I will be pleased to take questions.

DARPA'S MISSION

There are five things I would like you to carry away. They are the following:

Number one, DARPA maintains its mission to do revolutionary advanced military technology. That is what we have been doing since 1958 and that is what we intend to continue doing.

There is a lot of conversation about DARPA's impact on the civilian economy and, in fact, through our dual-use technology, we do have that impact, but as a spinoff.

There is conversation about DARPA's technology helping in our counternarcotics effort. That is true, but again it is a spinoff of our main-line programs and there is a lot of talk about DARPA helping the United States education system, and we do, but it is a spinoff. We are maintaining our main mission, point one.

NEED FOR NEW TECHNOLOGIES

Point two is despite all the changes in the world, we see a continuing need for DARPA, in fact, an increasing need despite the changes in Eastern Europe, in fact, perhaps because of them, a need for force projection, a need for increased readiness technology for the troops. We see in the declining defense budget the need to come up with new strategies and new technologies like upgrading systems in order to maintain or increase capabilities while controlling cost.

We need affordable arms control technology. We need to be able to deal with the sophisticated weaponry that is going into Third World countries. On the news last night, you heard of the attempted sale—and thankfully foiled—of nuclear weapon arming devices in the Middle East. We have to deal with those things.

DRUG INTERDICTION

We have to support the Department's increasing missions in counternarcotics and counterterrorism and face the fact that technology is getting globalized. It is going into Europe, Japan and the Far East, and our whole strategy of technology supremacy really is threatened, and we have to do something about it. That is point two, an increasing need.

DARPA FUNDING

Point three is that DARPA, I think, is a successful organization because of our business practices. It is the way we work and others could work the same way. We are a small organization, a flat organization, three people top to bottom. All our funding is based on competition. We have no fixed expenses year after year. It is all based on merit and rapid response. Our programs end with prototypes, not with vugraphs. We build things. We are funding industries, so we are giving seed funding to them and they pick up thereafter when the risk is reduced. We build teams and consortia. That is our normal business practice, which is nothing special. These business practices have led to, I think, a lot of success.

A calculation that I did that I found impressive in preparing for this hearing is that if you add up all the dollars DARPA has spent since 1958 and all the things we have accomplished, Stealth, supercomputers, it adds up to less than one year RDT&E investment of the Services. So I think we are doing something right.

Point No. 4, we went through a planning activity to figure out what our submissions should be from a zero-based budgeting point of view. We have to assess DOD missions, the systems that are needed and the technology needed to build those systems. That is how we put the budget request together. We have priorities and rationale. This is not presented to you based on the theology of the importance of research and development, although I certainly support it. It is a chain of logic from DOD needs to systems to technology.

INVENTORY

I would like to spend a minute telling you what kind of inventory DOD would have if all this stuff actually works and gets into use because we think of it in terms of integrated inventory.

We have survivable aircraft manned and unmanned, even more survivable than we have today and then the countermeasure, the targeting systems that go against those air vehicles despite CCD and denial of countermeasures. We would have survivable land vehicles, low attrition land vehicles, light-weight land vehicles, and survivable ships and then the countermeasure, the targeting system to go against those kind of vehicles when our adversaries have them, as they will, years later. We would have stealthy submarines more survivable than the ones we have today, but then we would have a new generation of acoustic and nonacoustic ASW to counter that kind of technology, measure and countermeasure. We would have survivable space assets and survivable space launch. DARPA's Pegasus launcher and SSLV launcher, the latter not yet built, are the only survivable space launch assets the country is going to have.

On the other side, we did a very interesting investigation for an economical ASAT system. It is a matter of policy whether you want to do that, but we are looking at both sides of the fence. We would have assured prosecution with networks of smart mines, smart weapons, and precision hypersonic conventional weapons. But then we would have a lot of countermeasures to that, like we have a whole countermine program to nullify this kind of technology, measure and countermeasure. We have some of the world's best technology for battle management, automated image analysis and communications analysis systems.

We have fielded some today on the shop floor of the intelligence agency, things that work and you can see if you do site visits: Battle management systems, transportation planning systems, survivable communications, including submarine laser communications, and the countermeasures, the C–3, the lasers, the medium-power microwaves, et cetera.

So we think of this as an integrated inventory and hope you will as well, and that is what we are trying to achieve.

[The statement of Dr. Fields follows:]

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

SUBCOMMITTEE ON DEFENSE
HOUSE APPROPRIATIONS COMMITTEE

STATEMENT BY

DR. CRAIG I FIELDS
DIRECTOR, DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

29 MARCH 1990

Introduction

Good morning Mr. Chairman and Members of the Research and Development Subcommittee of the House Armed Services Committee. I appreciate the opportunity to appear before you.

The mission of DARPA, the Defense Advanced Research Projects Agency, is to develop "revolutionary" technologies that can make a significant impact on the future of the United States' defense posture, and to ensure that those technologies effectively enter the appropriate forces and supporting industrial base. DARPA was created in 1958 in response to the challenge of Sputnik. Because revolutionary technology often crosses traditional disciplinary and organizational lines and involves a high degree of risk, it was felt by President Eisenhower that a different type of organization was needed, with unique business practices that I will discuss.

The world's political, economic, military and environmental landscape is changing at a historically unprecedented rate. And much of that change is driven by technology that itself is rapidly changing. The Soviet empire is undergoing remarkable metamorphosis, and who can say when or in what form Eastern Europe will stabilize; regional conflicts continue and will likely increase as will pressure to reduce overseas US military presence; technology in general and weapons technology in particular is diffusing throughout the world; and counter-drug responsibilities have been added to the Department's mission.

These are times of significant self-examination for the Department of Defense, and in particular for DARPA. We believe the mission of DARPA is, if anything, even more critical now than it was over thirty years ago. The technology challenge is greater and comes at us from a wider front. The Goldwater-Nichols DoD Reorganization Act of 1986 called for biennial review of all Defense Agencies, including DARPA, and I was very pleased with the October, 1989 review findings based on extensive interviews with the Military Services. They reaffirmed DARPA's importance and effectiveness, particularly in technology transition, and recommended an even stronger role for our Agency in the future.

We are now receiving a great deal of advice on how the Agency can best serve the Department and the Country in the coming decade.

We have been advised that in light of the severely limited resources available to the Department DARPA should shorten and narrow its vision, and concentrate on conducting near-term, relatively low risk research and development to address today's requirements and needs of the Military Services.

We have been advised that in light of the increased uncertainty in the global political and military posture DARPA should concentrate on long term investments to sustain the technology base, and thus maintain a rich and varied set of military technology options for the Department.

We have been advised that in light of the state of the Nation's economy we should concentrate on dual-use technology in order to shore up the US industrial base, thus contributing to national security through enhanced economic strength.

We have been advised that investment in dual-use technology is best left to the private sector and that we should concentrate our investments on military-unique technology that would not otherwise be available to the Services.

We have been advised that we should significantly contribute to the National counternarcotics effort. And we have been advised that the greatest danger facing the US is the state of our education system, and that we should concentrate our investments on training technology and on universities.

I am flattered that so many constituencies want DARPA to address their problems, but with limited resources we can't follow all of this advice. My main intention today is to describe the course we are actually following, a course consistent with the budget for DARPA submitted to the Congress by the President and the Secretary of Defense.

Reinforce the values of the past

As this is my first opportunity to appear before the Subcommittee as Director of DARPA I would like to take a few minutes to describe some of the business practices I am endorsing at the Agency, before spending the major part of our time on DARPA's technical directions and accomplishments.

I am making a special effort to reinforce the values that establish the foundation for DARPA and that have been our guiding principles and strategy for thirty-two years.

We are firmly dedicated to making investments that can cause fundamental changes in the operation of DoD and the Military Services. These investments with potential for very high impact are often accompanied by very high risk; they are often contrary to common views and vested interests; and they often break out of the chronic "chicken-egg" problem of the formal requirements process, namely that you shouldn't do R&D unless there is a formal requirement, and you can't formulate requirements -- like for stealth -- until you have done some R&D.

We try to be rapidly responsive to both technological opportunity and world events. We want no permanent commitments to laboratories, facilities, institutions or other fixed expenses.

Because of the inevitable and unfortunate delay between laboratory results and fielded weapons systems -- a delay the Department is trying to reduce -- we aim our investments at future problems, not just today's problems.

Our investments are organized as programs with a few characteristics almost unique within the Federal Government. We try not to start a program of investments unless we have some new technical idea, insight or concept to address a critical DoD problem or opportunity. At the time of inception our programs have a scheduled termination date -- we don't want to be in a rut. And none of our programs produce just vu-graphs and reports; they all produce technology demonstrators, concept demonstrators and system prototypes.

Our intention is to establish options for the Services in the defense industrial base. Unless a new product, process or service is available to the Department our investments cannot have an effect. That is not to say that we invest up to the point of product introduction. Most commonly we work with industry to reduce technical risk with seed funds, usually cost shared with companies, and then Service investment or private capital carries on from there.

We also provide major funding to American universities, National Laboratories and other research organizations But since our focus is on defense industrial capability we form teams among for-profit and not-for-profit organizations to facilitate technology transition. In fact since teaming is an inherent part of DARPA's business practice we find nothing unusual in the support of consortia like SEMATECH, the MCC, or the MIT/LL/IBM/ATT superconductivity consortium. Our posture toward consortia is exactly the same as any other investment.

Do these traditional DARPA business practices work? In our thirty-two year history we have supported the development of stealth; technology for Follow-On Forces Attack (FOFA) through the Assault Breaker program; armor/anti-armor technology like Tank Breaker that has evolved into the recently adopted AAWS-M; autonomous terminal homing for near zero-CEP cruise missile guidance; critical ASW technology like the SURTASS towed array; space technology like the Saturn booster; SIMNET networked simulation technology for training; phased array radars and over-the-horizon radars; the M-16 rifle; high altitude, long endurance unmanned aircraft; technology for submarine-laser communications; the Nation's nuclear test detection technology; the ARPANET; computer time sharing; interactive computer graphics; the Ada computer language; much of the technology in personal computers; parallel processing supercomputers; the field of artificial intelligence; computer-aided instruction technology; solid propellants for rockets; many developments in materials science like rapid solidification of alloys; manufacturing technology for digital gallium arsenide microelectronics and much more.

The total amount expended by DARPA from 1958 to the present, summing all years, is a bit less than one year's RDT&E expenditure in the Department.

Introduce new business practices

Although we have a record we can be proud of I am trying to introduce some new business practices into DARPA that can make things even better.

We are making heavier use of simulation and gaming to help us prioritize among R&D programs on the basis of projected military battlefield impact. To that end we are making use of our own SIMNET and distributed wargaming technology as an acquisition planning tool. An example is the use of SIMNET to assess the impact of counter-sensor lasers on the battlefield.

We are taking account of arms control in our program planning. In particular many of our technology developments for targeting -- reconnaissance, surveillance, target identification -- can be of use in treaty monitoring and we want the work to do "double duty."

We are trying to assess routinely the effects of countermeasures in all of our programs. I am a firm believer in the power of competition, and so we have competition within DARPA between programs developing a capability and other programs developing countermeasures to that capability. An example is our program in smart networks of mines and our program in mine detection; another example is our investment in ASW and our investment in submarine technology.

With the declining DoD budget we have to be cognizant of cost in all of our programs, not just the R&D cost but more importantly the much greater later cost of production, inventory, maintenance and training. As you will hear during the rest of this testimony DARPA is embarked on an aggressive set of programs to reduce DoD costs, of which manufacturing technology is the most visible.

We have always planned for technology transition to the Services, although you can appreciate the difficulty of arranging hand-off of a revolutionary technology. Now, however, we have to plan for transition in a budget climate that discourages new system starts. Our approach is to find ways to insert new technology and new subsystems to upgrade fielded weapons systems. For example we have been inserting subsystems using high speed, low power gallium arsenide microelectronics components in place of silicon microelectronics components into a variety of DoD systems, as discussed below.

DARPA is internally organized by offices devoted to military systems, offices devoted to high technology, and an office devoted to manufacturing technology. But viable programs must focus on system concepts, technology components and manufacturing approaches concurrently and cut across those office boundaries. We are now concentrating on cross-office programs in DARPA such as the application of leading edge supercomputers to ASW systems, the use of wafer scale microwave components in advanced targeting radars, and the development of manufacturing technology for infrared focal plane arrays for new smart weapons system designs.

In the FY 1990 authorization the Congress granted DARPA new authority to enter into cooperative agreements and other arrangements on a two year experimental basis. We have decided to use our new authority to further the strategic and long range goals of the DARPA research programs. Thus we have no special program for cooperative agreements outside our normal research programs, and entering into cooperative agreements is an opportunity for all DARPA program managers in the normal course of doing business, in parallel with negotiating contracts and giving grants. All of the evidence from our discussions is that this will be a very beneficial option for DARPA, and that it will make possible a more productive working relationship with industry and the venture capital/private investment community.

I am placing a major emphasis on improving the number and nature of our international programs. High performance military and dual use technology is being developed in Europe and the Far East, and we have to take advantage of those investments by allies. My intentions are to reduce costs through shared development and greater commonality; to make the very best technology available to US military forces; and where possible to encourage technology transfer into the US defense industrial base. We expect to expand our European office located in Germany, and we are in the planning stages for an office in the Far East. Our emphasis is on applied technology and industry, not basic research and universities which are well covered by other DoD components. We currently have a number of very successful international programs and we want to build on that base. These include efforts with the Federal Republic of Germany on an enhanced maneuverability aircraft (X-31) and on advanced armor; with France on reactive armor; with the UK on electromagnetic launchers, tandem chemical energy shaped charge warheads, and an advanced short take off and vertical landing aircraft, and others.

Incidently, we've developed the X-31 experimental aircraft in just over three years from program start -- a good example of rapid prototyping. We are about to begin flight testing. Some of the technology developed can be employed to retrofit current aircraft, like the F-15, F-16 and F-18 as well as for inclusion in future new aircraft.

I briefly mentioned our support for universities. Since the highest quality human resources are so critical to national security I am trying to emphasize our contribution to US student education. By charter we are limited to supporting education as a side effect of our investments in research and development, but that effect can be great. We support a large number of graduate students at major US colleges who are working on R&D contracts and grants in some of our areas of concentration, e.g. computer science and materials science. Major pieces of equipment purchased to perform the R&D comprise an invaluable infrastructure of supercomputers, networks, semiconductor production equipment, materials processing equipment and such. By forming teams between US universities and US industry we provide students with the opportunity to get practical experience, e.g. in manufacturing. And some of the training technology we have developed for the military is also finding application in civilian instruction.

We have had a few organizational changes within DARPA in the last year, with the intention of strengthening programs and structuring around our highly skilled personnel. Perhaps the most visible change has been in the area of naval technology. We have combined our technology efforts in ASW with our programs in tactical and strategic detection, location and recognition in a single technical office. The concentration is on sensors, digital and analog signal processing, data fusion and area limitation and system prototypes in ASW, air defense, smart weapons and such. In another office we have our efforts in advanced platform technology -- submarine and unmanned undersea vehicle technology, advanced aeronautic technology and other activities. The concentration is on advanced structures, power and propulsion, control, reliability and safety, and both platform and subsystem prototyping.

Strengthen DARPA's relationships

We've worked hard in the last year to strengthen DARPA's relationships within the Department and with other parts of the Federal Government.

Within OSD DARPA is part of the USD(A) organization, but I have made a special effort to try to bridge the gap and also provide a technical resource for USD(P) in areas like arms control and export control. Working with USD(P) we have arranged for a senior member of the DARPA staff to support our CFE negotiations in Vienna over the next year as science advisor to Ambassador Woolsey. Also, at the request of USD(P), we have provided senior technical advisors as members of the U.S. delegation to the Nuclear Testing Talks as well as conducted special technical studies in support of these negotiations. We have also provided technical expertise on behalf of OSD to the Conference on Disarmament discussions in Geneva.

Also within OSD we have been working with the Balanced Technology Initiative (BTI) to forge a new relationship as that Initiative undergoes redirection. My view is that the BTI can serve a useful partnership role in working with DARPA. To explain I have to go back a few years.

As you may recall the Packard Commission recommended that DARPA become more heavily involved in prototyping. The intention was to reduce the time to field new technology, and to reduce the uncertainties of development and production schedule, cost, and performance that sometimes plague large scale developments. Before the Packard Commission DARPA had the charter to engage in prototyping and had done so on a number of occasions. The recommendation of the Commission made a great deal of sense but has not yet been truly implemented for funding reasons. To date, no new resources have been made available to DARPA to develop prototypes above and beyond those prototypes that would be developed within prior budget guidance.

BTI may serve the function of the DARPA prototyping initiative recommended by the Packard Commission. I would hope that part of the BTI could be instrumental in transitioning selected DARPA technology from concept demonstration or technology demonstration to prototype status. In light of the Department's budgetary situation we are focusing on system upgrades, subsystem insertion, or low cost systems.

Within DoD our main relationships are with our customers, the military users. We currently have 52 joint programs supported by Memoranda of Understanding, about 30% each with the three Services and 10% with other components. But those 52 MOUs document only a fraction of our joint activities, many examples of which will be described.

We have been strengthening our relationships within the Federal Government outside DoD. Two connections are particularly noteworthy. First, although DARPA is dedicated to filling national security needs, we are part of the Government's science and technology community. In some ways we are almost a unique part in our focus on dual use pre-competitive enabling industry-based technology in such critical areas as communications, computers, semiconductors and materials. We have been working closely with the President's Science and Technology Advisor, OSTP (Office of Science and Technology Policy) and the FCCSET (Federal Coordinating Council on Science, Engineering and Technology) to assure that our investments mesh with other parts of the Government. For example, our staff played a pivotal role in defining the High Performance Computing Initiative. That Initiative could be very important for DoD in enabling technology required for such computationally-intensive military tasks as ASW, signal analysis and so on.

Second, we have worked closely with the Department of Commerce and NIST. DARPA has been funding reimbursable projects at NIST for a number of years, and we have invited their participation in our work in high definition displays and with SEMATECH.

Recruit, retain and motivate the highest quality personnel

DARPA's successful operation depends almost entirely on recruiting, retaining and motivating the most capable entrepreneurial technology managers we can find. I consider every member of the DARPA staff to be a recruiter, and recruitment takes up more of my time than any other single activity.

I had considerable anxiety upon assuming my position that issues of salary, uncertainties in ethics legislation, and the general atmosphere of Government service would make it impossible for me to recruit personnel up to DARPA's quality standards. However, we have done quite well in the last year despite those impediments. Recruitment is a positive feedback system -- after a few top notch people come, more want to join them.

Forty-one new technical staff have joined DARPA in the last year -- I think we have turned a corner in recruitment. In addition the quality of our staff is being formally recognized. Besides an outstanding complement of DoD award winners, the Director of our Nuclear Monitoring Research Office was awarded a Presidential Rank Award, along with the past DARPA Director and DARPA Deputy Director for Systems. Further, the Director of our Information Science and Technology Office was the recipient of the nation-wide Grace Hopper Award for his unique and outstanding contributions in the field of software. And a number of our military officers were promoted by their Services. I make a special effort to support the professional advancement of our military staff.

The military officers on the DARPA staff, comprising about a third of our technical personnel, are especially critical for assuring that DARPA's investments address Service needs, and when they return to their Services they provide "automatic" technology transition.

This year we began a program with the Army in which that Service details to DARPA some of their smartest technical Ph D.s. This provides much needed manpower for DARPA, exciting assignments for the officers, and serves that all important technology transition function. I hope similar programs can be arranged with the Navy and the Air Force.

In painting this positive picture of our current personnel situation I would not like to leave you with the impression that things can't be improved. I would benefit from a smaller gap between DARPA salaries and industry salaries and I continuously face the regrettable side effects of well intentioned ethics legislation.

Develop a long range plan

I'd now like to turn to the DARPA technology investment strategy. In defining our FY 1991 budget submission we assumed a responsibility -- in light of radical changes in world politics, military status, economics and technology -- to take a fresh look at DARPA's investment strategy and ask some fundamental if radical questions. Why should DoD do any R&D: perhaps we should just buy things and let industry do the required research motivated by the opportunity to make a profit? If we were starting DARPA from scratch, what R&D programs would we begin?

With respect to the first question, our approach has been to identify that R&D which is so risky, so long term, so difficult for an individual firm to appropriate for its own benefit, so unlikely to generate sufficient profit and yet so important to DoD that DARPA's investment is justified.

With respect to the second question, we approached our long range plan by assessing the major world events that would affect our investment strategy; identifying and prioritizing DoD missions requiring technically enhanced military systems; identifying and prioritizing the military systems DARPA should develop to support those missions; identifying and prioritizing the technologies DARPA should advance to make those military systems possible; and identifying and prioritizing the manufacturing technology and other measures DARPA could support to make those military systems and technologies affordable and of the highest quality.

We defined our FY 1991 budget submission to match those priorities as well as possible in light of some real world constraints such as pre-existing contracts or the quality of technical ideas and availability of personnel. I want to tell you the major results of that analysis.

Respond to world events

We have tried to respond to six major world events in defining our long range plan. First and foremost is the renewal of freedom in Eastern Europe. No one is more overjoyed than I at the fall of a half dozen dictatorships within the space of a few months. But when faced with supporting national security I am left a bit perplexed.

There is every indication of a change in military and political intent, but intent can be quickly reversed. There are also changes anticipated in military capability, which will be less easily reversed. If our arms control aspirations come to fruition both Soviet and US forces will be reduced in number and will withdraw in part from forward basing. But the era of *glasnost* will inevitably cause a significant influx of high technology into the Soviet Union that will facilitate technical modernization of their forces - they may end up with a smaller but more capable force.

The potential reduction in US forces deployed overseas places a premium on effective deployment. Some of the technical implications are the need for: more effective transportation planning systems to use efficiently our air and shipping assets; more survivable ships through ship upgrades; better control of sea lanes with improved submarine forces and ASW; and, lighter forces based both on inherently lighter materiel and technology to lower attrition.

With fewer active duty troops and fewer large scale field exercises with our allies, technology to make possible distributed simulated but realistic training exercises will become essential for both active duty and reserve forces in all Services.

There will also be a continuing if not accelerated need for the highest quality intelligence, including a better match between our excellent collection capability and our ability to analyze incoming data..

Second, the DoD budget will probably decline. This calls for a number of cost reduction tactics, including: upgrading fielded military systems with advanced technology; reducing inventory size and variety by employing higher performance systems; reducing manufacturing cost with new technology, such as computer aids to design, production scheduling, ordering and inventory; and, reducing acquisition cost with automated ordering systems.

I will discuss a number of DARPA initiatives that can reduce the cost of defense, but I want to return to one outstanding example here. Over the last few years DARPA has pioneered the development of manufacturing technology for digital gallium arsenide microelectronics circuits. Most computer chips are now made of silicon, but those made from gallium arsenide have major advantages in terms of speed and power consumption. The difficulty is that we have had much less experience in making gallium arsenide digital components, and until recently yields -- that percent of parts made that are of good enough quality to be used -- have been impractically low. DARPA supported the development of three pilot production lines that have achieved world's records for digital gallium arsenide integration and yield. Now we are trying to insert gallium arsenide chips into fielded military systems in order to improve performance and in some cases save the cost of a whole new system. We have eight such projects jointly with the Services: upgrade of the distributed array processor in the Air Force RC-135 reconnaissance aircraft to process six times as many simultaneous signals; upgrade of the signal processor in the Navy P-3C AN/APS-137 surface search radar to double inverse synthetic aperture radar (ISAR) image resolution; and others in weapons and combat support, electronic warfare and communications, and space systems. There is no pretense that such upgrades can equal the performance of a "cost-no-object clean-sheet-of-paper" approach -- but brand new starts are likely to become rare events.

Third, there will probably be agreement on a significant series of arms control treaties, e.g. START and CFE, with increased need for arms control monitoring. Part of the monitoring task is congruent with wartime needs for target location, identification and tracking so some of the same sensors, systems, and management tools will apply. In other cases there will be unique technical challenges.

Fourth, Third World countries are buying increasingly sophisticated weapons. There are CBW capabilities in over 20 countries; ballistic missile production in 15 countries and surface-to-surface missiles in almost every country in the Middle East; tanks and armored vehicles (and armed helicopters) in most countries in Central America and almost 2000 such vehicles in Cuba; major combat aircraft forces in Libya, Syria, Pakistan, North Korea, Iraq, Vietnam and other countries; and thousands of main battle tanks in those countries; quiet submarines are being produced and sold throughout the world.

It is reasonable to expect that the US may be involved in regional conflicts or that we will support our allies in the Third World in such conflicts. We must be prepared for Third World battlefields that are in some ways as demanding as those we have long planned for in Central Europe. In terms of technology we must assure global reach in spite of a trend away from forward basing. That global reach must include increased reliance on space to provide the area coverage we need world-wide.

Fifth, the Department has new responsibilities in supporting the President's National drug control strategy. By and large that is not a matter for new technology so much as effective operational employment of what we have. But in a few special cases involving communications, information collection and sensors technological advances can make a real difference.

Sixth, the Far East has become a leading world center of high technology and Europe, particularly with EC 92, will not lag behind. This globalization of technology with inevitable concurrent relaxation of COCOM controls means that it will be difficult to sustain our strategy of countering military quantity with superior technical quality. To exacerbate this development, dual-use technology is playing an increasing role in military systems so that it is no longer possible to find the boundary between the defense industrial base and the general manufacturing base of the US or any other country.

This globalization of technology has many implications for the Department. Attracting the finest personnel to military service will be more important than ever, as will the employment of the most effective training technology to hone combat skills. In order to have the finest military force in the world we will have to "go international" in our development and acquisition of technology, and face the tough problems of balancing military cooperation and economic competition. And we must be poised to exploit temporary technical advantages in the most expeditious manner possible. This will require increased emphasis on prototyping, more use of upgrades of fielded systems, and the use of sophisticated automated acquisition tools.

Provide options for national security

DARPA's investments are in advanced, high performance military systems; technology to make it possible to build those systems; and manufacturing and acquisition technology to make the military systems and technology affordable and of the highest quality.

In describing our work, two themes should stand out. First, while we are doing work on platforms and warheads, our real emphasis is on information: collection, analysis and planning, as well as denying information needed by our adversaries. We are in the midst of a microelectronics revolution, and the nations that can harness that technical progress for military ends will have an overwhelming national security advantage.

Second, we are doing everything we can to lower the cost of defense. There is no question that in the future DoD will have to make do with less. And yet there is enough uncertainty about future threats that reduced responsibilities may not match reduced budgets for some time.

I want to begin with our work in innovative military systems. While our selection of military systems was in no way meant to provide a complete inventory for DoD in the next century, in fact there is a fairly complete "food chain": reconnaissance, surveillance and target acquisition in the face of camouflage, cover and deception, denial and countermeasures for air, land, sea surface, and undersea platforms and fixed sites; battle planning to manage scarce resources and assured communications to weapons systems; and weapons systems that should prove unusually effective against all target classes.

"Hide and find"

We are doing work in five areas. First, we are investing in a new generation of systems for reconnaissance, surveillance, target acquisition and identification in the face of countermeasures; and we are investing in the most advanced countermeasures to deny target information to our adversaries. This is the so-called "hiders and finders" business. A new generation of systems is made possible by a new generation of enabling components for, say, digital radar. This work is central to our mission of avoiding technological surprise. We have combined our work on automatic target recognition for tactical targets with our effort aimed at finding strategic relocatable targets in order to assure the greatest commonality. And we have redirected the integrated effort to address future targets that will employ the most sophisticated denial countermeasures.

Some of the exciting results we have obtained this last year are part of our smart weapons program discussed below. In addition we have been making real progress in our relocatable target program. Perhaps the best data comes from our use of polarimetric SAR imagery. We have been able to reduce the false alarm rate in wide area search by about three orders of magnitude while maintaining 70% detection rates with targets practicing CCD techniques. We are also looking at a number of novel sensors with the promise of major improvements in targeting

Dominate undersea warfare

Second, we are developing technology to assure dominance in undersea warfare. This includes our efforts in ASW, centered on finding enemy submarines in the face of both quieter Soviet submarines and quiet diesel submarines available to Third World nations. And we are investing in submarine technology, most of which is concerned with submarine stealth. I hope DARPA can do for submarines in the 1990s what we did for aircraft in the 1970s -- assure survivability, reduce attrition, make possible new missions. We are working on submarine shaping with the required changes in internal machinery, structural acoustics, surface materials and active measures. We also have joint efforts with the Navy on unmanned undersea vehicles, and we are integrating that work and the projects in submarine technology. In our work in ASW and submarine stealth you see our theme of measure-countermeasure.

Most of our ASW activities are classified, but I can sketch the outlines of some of what we are doing. In the area of passive acoustic ASW the value we are trying to add to the ongoing Navy activities relies on information processing technology -- supercomputers and artificial intelligence -- to improve effective detection. We have shown 10 dB to 20 dB improvement with SURTASS data using computationally-intensive adaptive beam forming; real time exploitation of non-traditional transient signals; 15 dB to 25 dB improvement in signal to noise ratios with ocean floor distributed sensors; and a good deal more.

As an unclassified illustration of our efforts to link our technology efforts with our military systems work, last year we installed a breadbox-size supercomputer, the Aspen supercomputer made by ATT, on the USS Augusta, applied to ASW target motion analysis. We have speeded up processing time by a factor of 150 thus achieving real time operation -- the calculation that took 2 hours is now done in 24 seconds.

We've had a number of significant accomplishments last year in submarine technology. To name a few: in the area of structural acoustics we've had some very successful subscale tests; in propulsion we've begun work in electric drive and magnetohydrodynamics, fabricated the required 240 kW solid state power switches, installed the first at sea magnetic bearings; in energy sources we've built two 4 kW advanced membrane fuel cells; evaluated very impressive electromagnetic signature reduction techniques; made major advances in hydrodynamic design, boundary layer control and propulsor design; constructed and successfully tested advanced 3-D reinforced composite submarine structures, and much more. About 70% of the program is devoted to submarine stealth including enabling technology. Some of the work is applicable to upgrading the 688 and Trident class submarines, or can be incorporated into the SSN 21 design. But as you might expect the most impactful advances are so fundamental that they are really aimed at future submarines.

Test, evaluation and transition of our results from the Advanced Submarine Technology Program are being facilitated by the availability of the USS Memphis, an attack submarine that has been designated by the Navy as a test bed for advanced submarine technology.

Our work in submarine technology is closely integrated with our program in unmanned undersea vehicles. As you recall we have been building a prototype UUV which is 36 feet long, 44 inches in diameter, and suited for such missions as mine hunting or undersea surveillance. With a titanium hull, special non-corrosive engine components which will provide propulsion even if the engine is completely flooded with seawater, fiber optics data links, and fault tolerant computers this is a very sophisticated system. The UUV will begin testing this Spring. We have worked closely with the Navy to assure that this prototype will feed into a scheduled FSD.

Several years ago DARPA developed systems -- and supported test deployment in the Persian Gulf -- to counter sea mines using both laser radars and sonars, and we are still involved in that area. In fact this year we have demonstrated that we can accurately classify mine-like objects using neural nets and a sonar that models the sounds of the dolphin. In the next two years we will be building on this sensor technology to demonstrate an unmanned undersea vehicle that can perform mine countermeasure missions. Our progress to date suggests that we may soon be able to augment current mine hunting assets with highly automated systems that can reduce risk to humans and improve performance as well.

Assure military use of space

Third, we want to improve our nation's use of space as part of our global information network, and in particular, assure military use of space.

DARPA themes of applied electronics and information technology, cost reduction and rapid technology transfer are particularly appropriate in the space arena. Our advanced satellite technology program (ASTP), sometimes called LIGHTSAT, is developing and will demonstrate a survivable space launch capability through two mobile launchers: Pegasus, which is launched from a B-52, and the Standard Small Launch Vehicle (SSLV). We are looking forward to our first live Pegasus launch this month, and expect to follow with two other launches in the near future. Since these relatively small mobile launchers have modest payloads, most of our investment is on advanced satellite technology that gives you more "bang for the kilogram," more functionality in a small package. We are looking at a variety of space technologies involving communications, visible and infrared optics, advanced microelectronics and microwave integrated circuits, advanced computer processors, data compression, and techniques that will improve the ability of satellites to operate autonomously and thus reduce housekeeping overhead. Specific applications of many of these technologies will be demonstrated this year with launches of the MICROSAT and Multiple Access Communications Satellite (MACSAT) systems. The demonstration of these programs involves not just the launch and the satellite, but their control and ground stations as well. As with the satellite themselves, the ground segment emphasis is on applying advanced technology to achieve lower cost operation, flexibility, and system robustness. Our near term system demonstration program will begin next summer and involves worldwide users at EUCOM, PACOM, SOUTHCOM and others.

Of course, ASTP technology can be applied to larger satellites to increase their functionality, and we are taking special care to ensure that all ASTP systems are inter-operable with more conventional space systems so as to permit incorporation of these systems into our evolving national space architecture.

Assure prosecution

Fourth, we are doing work in weapons systems for assured prosecution, but our investment here is modest because we don't want to duplicate ongoing Service programs. We have an excellent program to develop the technology for smart networks of land mines. Mines, particularly those that are air deployable, are a very cost-effective defense. When coupled with microprocessors, multiple sensors, a little artificial intelligence and some low bandwidth communications they become smart weapons that the US should have in their inventory. That same systems technology, incidently, provides a capability for smart networks of unattended ground sensors, supporting the "hiders and finders" goals. We are looking at ways to extend our effort to sea mines, but we have not done so as yet. Complementing our work in smart mines is the development of counter-mine detection technology -- again measure-countermeasure.

Our work in smart weapons is mostly concerned with the automatic target recognition mentioned above, but also includes a battle management component in the form of automated route planning. How should the smart weapon adaptively plan and replan its route to evade enemy defenses while optimizing its search and prosecution? In the smart weapons program we are not trying to build an entire new smart weapon but rather an advanced sensor and avionics suite that can be inserted into existing and future platforms as an upgrade. Further, the same smart weapons technology can be employed with appropriate man-machine interfaces as an aid to pilots in manned platforms, assisting with route planning and target location and identification. This can feed into our Pilot's Associate Program.

The results we have obtained this year in our smart weapons program have so far exceeded my expectations that I want to tell you some of the numbers. The problem addressed has been the fully autonomous location, recognition and warhead delivery to high value targets like surface-to-surface missile launchers. We want to succeed despite the best efforts of the enemy to employ CCD, denial and countermeasure techniques, e.g. camouflage nets and foliage cover. We are making use of combined sensors selected from near IR and far IR imaging sensors and active millimeter wave and IR laser radar. Information from these sensors can be augmented by RF intercepts, area limitation software and collateral intelligence data. When we started the work we could only recognize 20% of these difficult targets and we had a high false alarm rate. Now we are up to about 90% recognition with a low false alarm rate. Because the computer operates much faster than people, this performance will yield area search rates that exceed human ability by a factor of 5 to 10.

Finally, we have a joint program with the Air Force and the Navy in the area of hypersonic weapons. The goals are to prosecute targets at the considerably greater distances made possible by hypersonic speeds and to quickly prosecute targets employing denial techniques -- we need to counter widening circles of uncertainty between "glimpses" of a target. The main technical challenges we are addressing that are unique to these weapons are in guidance and control in the severe hypersonic environment. If successful, this technology will give us the option of world-wide so-called "zero CEP" capability with conventional warheads. However, I can't predict whether arms control considerations will limit production and deployment.

Before we leave the area of weapons systems for assured prosecution I want to say a few words about our armor/anti-armor program being conducted jointly with the Army and the Marines. FY 1990 is the last year of a five year MOU among those Services and DARPA in which the Agency has invested about a quarter of a billion dollars. It has been very successful in developing new armor/anti-armor technology, in strengthening the defense industrial base in this area thus providing procurement options for the Services in the future, and in developing new methods like the Red Design Bureau's unique approach to experimental intelligence assessment. While most of the accomplishments are classified, I want to mention a few high points: advanced three dimensional hydrocodes for simulation of armor/anti-armor interaction; a factor of 400% cost reduction in ceramics armor manufacturing; the best shaped charges in the free world, and novel warheads to neutralize reactive armor; guided kinetic energy rounds exceeding all others in range; the first electric guns firing at tactically effective energies (8 MJ); survivable communications links for smart mines; an anti-helicopter mine to deny the pilot the cover advantages of low level flight; and much more.

We are continuing to invest in armor and anti-armor, although at a reduced level, in FY 1991, and we will sustain our commitment to the highest technology aspects of the field, including high energy density materials, pulse power sources for electromagnetic launchers, ceramics production, and smart high precision munitions. Further, I view that our efforts in smart networks of mines, in smart weapons, in battlefield reconnaissance, surveillance and target acquisition, and in vehicle survivability are all parts of the armor/anti-armor equation

Manage and plan combat

The fifth area of concentration is battle management and C^3I. This is an area where DARPA can cause a fundamental paradigm shift for the Department. Our central focus is on automated and semi-automated battle management and battle planning systems for the Services. With advances we have developed in supercomputers and artificial intelligence technology we believe the time is right to develop systems that can help the commander develop battle plans in real time, taking into account tens of thousands of pieces of data and considering tens of thousands of options. It should be possible to ask "what if" questions and to develop new plans in response to battlefield developments within minutes instead of hours and days -- "out deciding" the enemy.

This is not idle speculation. For several years we have had joint programs with all three Services, like the Fleet Command and Control Battle Management Program (FCCBMP) activity with the Navy and the Air-Land Battle Management (ALBM) activity with the Army, which have produced results consistent with this vision. For example, the ALBM program has produced systems that reduce the time to develop maneuver and fire support courses of action (COAs) at the corps and division level by a factor of 12, and considerably more progress is expected soon. And the FCCBMP effort has been so successful that it is being transitioned into the Navy Operational Support System (OSS) for distribution worldwide at the fleet CINC level.

I am particularly excited about our efforts to help USTRANSCOM. As you know, that command is responsible for developing Time-Phased Deployment Data (TPFDD) and the recent Proud Eagle Exercise in October 1989, which involved every CINC, demonstrated that automated tools for transportation planning and scheduling could have a major impact. We want to apply our supercomputer and artificial intelligence technology to the Joint Operational Planning and Execution System (JOPES) and the Global Transportation Network (GTN). Our goal is to provide adaptive planning in minutes or hours instead of days or years, to produce better quality transportation plans for force deployment, and to reduce significantly the manpower required for planning support.

While my main intention for this technology is to make major advances in battle management, the same technology can serve a peacetime role in reducing Department operating costs and in helping us to manage scarce assets in arms control treaty monitoring.

Battle planning cannot be successful without good data. We have two joint programs with the intelligence community to automate the process of imagery and signals analysis. As you might expect these are classified activities and I can't go into the details. The principle, however, is to apply our supercomputer and artificial intelligence technology to process automatically some of the vast quantity of data we now collect. We barely have the personnel resources to keep up with peacetime demands, and automated aids are absolutely essential to keep up with wartime requirements. Our policy has been to build prototypes to put "on the shop floor" in the hands of the users.

Further, we are developing survivable communications technology: as submarines are an integral part of the force structure we are investing in submarine-laser communications. The technology we are developing is two way, low-probability-of-intercept communications based on reliable solid state lasers that are lightweight, prime-power efficient and modest cost. Our uplink is a blue laser matched to a cesium atomic line resonance receiver at 455.6 nm; our downlink is a green, diode pumped laser compatible with existing submarine receivers at 532 nm, and with sufficiently low weight, volume and power to be practical for high altitude, long endurance unmanned air vehicles. Incidently, our downlink laser holds the world's record for power efficiency. With greater than 70° incidence angle communications we should be able to provide attractive area coverage. This is a near-term prototype demonstration employing the USS Dolphin. This technology may be extensible to space applications in the future and we are considering it as a candidate for our Advanced Satellite Technology Program.

With our measure-countermeasure theme we are investigating the use of lasers and medium powers microwaves to disrupt enemy capabilities in

C^{3}I, as well as the sensor and system protection technologies we will need against directed energy threats. We've achieved our first demonstration of electronics burnout with medium power microwaves. Physics International Co. demonstrated burnout of typical radar receivers with orders of magnitude less power than previously achieved by tailoring the waveform for maximum effectiveness. The consequence will be dramatically smaller microwave sources for tactical use. For the electronic warfare arena, we are looking at new ideas to defeat monopulse radars, and we are determining the ECM capabilities of ultra wide-band RF sources. These advances in EW depend on the most sophisticated microelectronic components, like our acoustic charge transport (ACT) device based on analog gallium arsenide. Incidently, that same device will have many dual-use commercial applications, like significantly increasing the data storage capacity of computer magnetic disks by correcting recording distortions that currently limit bit density.

A critical part of our battle planning investment is the development of distributed wargaming technology that will hone the battle management and battle planning skills of our commanders. Beginning in the early 1980s we developed distributed simulation technology that has been adopted for use at lower echelons, and more recently we are emphasizing extension of the capability up to the CINC level.

Building these five kinds of military systems depends on major advances in the underlying enabling technology. This dual use technology forms the basis for DARPA's military systems work and provides the technology for unanticipated military systems needs. Most of our investment in advanced technology is in information technology and materials technology.

Transform Information technology

DARPA has played a leadership role in information technology since 1961 with the very first investment in a newfangled idea called time sharing. Currently we are concentrating on pushing out the performance envelope in high performance computing, artificial intelligence, computer communications and software development.

High performance computing is the underpinning for most of the military systems described above. We need high performance computers with capabilities far beyond those commercially available today to achieve high levels of performance in automatic target recognition, survivable platform design, real time ASW calculations, battle planning, automated imagery and signals analysis and much more.

In 1983 we began developing a technology base for parallel processors. These are supercomputers that gain their performance and cost advantage by the clever connection and programming of large numbers of relatively slow microprocessors. In contrast, conventional supercomputers gain their speed advantage by employing very high speed microelectronic components.

The parallel processing approach to supercomputing has been a success. Many new companies are now selling machines, and other established firms like Intel have developed new products. The supercomputers have very high performance, are cost effective, and have the compactness and low energy use/heat dissipation needed by the military. How much better are the new parallel machines? Comparing the ATT Aspen DSP3 with a conventional supercomputer, it is 35X more cost effective; 143X more power efficient; and 7X more volume efficient. We have been developing programming tools and operating systems for parallel processors as well, and some like Mach are becoming commercially available. Mach is becoming the unofficial successor to Unix as a world wide standard. It is Unix compatible, except faster. It is inherently suited for parallel processing. It inherently supports distributed computing in which different parts of a system operate in different places on a network enhancing survivability. And a so-called trusted version will be certified for classified military applications. That trusted version will also provide some protection from virus attacks.

Some highlights of emerging military applications of these extraordinary machines: the Army Engineer Topographic Lab is placing a 64,000 processor Connection Machine supercomputer in a hardened mobile trailer in support of their image exploitation system (IES), and it is bound for Europe to V Corps; CINCPACFLT is using the same hardware in a Navy air threat planning application, doing their calculations in seconds rather than hours; the iWarp multiprocessor signal processor is being used by NOSC for OTH radar analysis, by NRL for sonar analysis, by BRL for impact/penetration physics calculations, by Wright Patterson AFB for relocatable target calculations and to upgrade the F-15 with automatic target recognition, by Harry Diamond for Army automatic target recognition modeling, by NADC for airborne early warning calculations and ASW signal processing, and by the Naval Coastal Systems Center for automated detection of torpedoes and mines.

We are now developing the second wave of machines that will achieve 100 gigaflop performance by 1992. These will be the basis for TeraOp (trillion operations per second) performance systems by the mid 1990s employing advanced microelectronic packaging like hybrid wafer scale integration, optoelectronic interconnect among components, gallium arsenide parts, special custom accelerator chips, ULSI components (10s of millions of transistors) and specialized algorithms designed for the new supercomputers.

Incidently, this technology scales downward to a gigaflop (billion operations per second) in a soupcan size package for smart weapons applications or a supercomputer on the desktop for engineering design calculations.

The impact of some of our investments in high performance computing is in fact at the low end of the performance spectrum. We invested in the development of RISC (reduced instruction set computer) microprocessors to provide a component for very high performance computing systems involving thousands of such microprocessors. And now that design has been chosen as a standard by DoD's Joint Integrated Avionics Working Group (JIAWG) for use in advanced aircraft programs. Lockheed and Texas Instruments among others are producing subsystems to insert into a variety of military aircraft. DARPA's RISC processors have also become the basis for the next generation of high performance work stations (50 - 100 million instructions per second).

Our work in artificial intelligence is now concentrating on systems that can plan and schedule, and systems that can learn to improve automatically their own performance.

We are also investigating neural networks as a promising approach to high performance data processing. Neural net methods involve massively parallel computing architectures which are patterned after the structure and functioning of the brain. These specialized systems show impressive abilities to recognize and classify patterns, a capability central to many military applications, such as sonar analysis, automatic target recognition, word spotting in communications intelligence, and such. Dedicated neural net hardware also offers the promise of extremely high computing performance in compact, light-weight implementations which might be suitable for missile guidance and other demanding applications. Our particular emphasis in the area of neural nets is to understand how to apply the technology to very large scale, and hence realistic, problems of interest to the military. I believe we will have some exciting answers in the next few years.

In the area of communications technology we are trying to extend the packet switching technology we invented and which is now a *de facto* standard to the realm of very high performance. We have developed a cross-country megabit capacity packet switched network which is being used for several defense applications. We are planning to install a similar NATO network in Europe, initially to support wargaming. We are also making progress toward gigabit or billion bits per second networks. The challenge here is not gigabit dedicated links which are readily available with fiber optics, but the switching of information at these rates to support flexible and survivable defense communications.

Our investment in software is in three parts. First, we are supporting a basic research program, mostly university based, to push out the frontiers of software implementation technology. As you know software is increasingly critical to military systems and increasingly complex and difficult to develop reliably and efficiently. Our formal software methods effort has for the first time produced a mathematically verified implementation not just of a computer software program but also of the underlying software compiler, assembler, and hardware design down to the gate level.

Second, we are working with all three Services on the STARS program. This effort is producing Service proof-tested open-interface commercially supportable software engineering environments which will serve to integrate and stimulate a DoD-supportive commercial software tools marketplace. STARS is also developing technology supporting the reuse rather than redevelopment of software, including the recent development of an automated software cataloging and repository system. A recent STARS application of reuseable Ada software to a Navy command and control system reduced a 50,000 hour software engineering effort to 10,000 hours -- they reused software from an Army system.

The third part of our software investment is the support of the Software Engineering Institute or SEI. While DARPA normally does not support facilities or institutions, the SEI is a worthy exception. Their mission is to transition the best software practice to defense industry, including products of the DARPA software research program and the STARS program.

The SEI has an important additional function. They operate for DARPA the CERT or Computer Emergency Response Team. When Robert Morris Jr. introduced a widely publicized virus into the ARPANET we quickly responded and within days we established an organization to handle computer virus epidemics similar to the way the CDC (Centers for Disease Control) in Atlanta responds to medical epidemics. That organization within the SEI has been active and successful. We chose the SEI to support the CERT since virus problems are software problems, not network problems, as sometimes commonly believed.

Advance materials technology

In addition to our work in information technology DARPA has a robust investment in materials science. We have a commitment to make available for Defense advanced structural materials, like metal-matrix composites, ceramic composites, intermetallic alloys, and other structural materials that are light and strong, and retain those characteristics at extreme temperatures. Our emphasis is on the processing, fabrication and production of the advanced materials, with a major goal of reducing costs.

We have a major effort in production of high temperature ceramic superconductors. We are developing analog devices, A/D components, bearings, digital devices, gyroscopes and accelerometers, IR sensors, magnets and motors, RF cavities and antennas, and SQUIDS with 47 ongoing development contracts. We expect some of the earliest applications to be in passive microwave devices and we are currently in pilot production of the underlying thin films. We are planning a space experiment jointly with the Navy in FY 1992.

A new direction for DARPA in materials is the development of very high energy density and high power density batteries based on thin film technology and on efficient fuel cells. Such power sources are needed for any number of our military systems, like smart weapons, unattended ground sensors and unmanned undersea vehicles. One particularly exciting development is a solid state lithium polymer battery produced using low cost techniques borrowed from the photographic film industry. This battery has 5X the energy density of NiCd batteries -- and we think we can get it up to 10-15x -- but equally important for military applications it is conformal (can be produced in many shapes to fit into weapons systems), and it is virtually impervious to damage. Imagine a battery which you can pound with a hammer, drive nails through, cut in half, and heat to the smoking point -- and it keeps working.

We are also making excellent progress in microelectronics materials, including optical materials for optical computing. Converting data to packets of light allows us to communicate at the highest speed with no cross talk; this in turn makes optics a powerful tool for processing images and other highly parallel computations. This year our 16x16 optical crossbar switch was first employed in a classified intelligence application; and, Honeywell is commercializing the DARPA-developed fiber optic high speed (1 gigabit) transmit/receive module for network applications, and as interconnects in the supercomputer Connection Machine, to list a few examples.

Besides materials *per se* we have developed new optics fabrication technology based on holography which can provide light weight and low cost front ends to smart weapons and battlefield target acquisition systems. This new fabrication technology completely bypasses the traditional problems of special glasses, special grinding tools and precision grinding, and the other limiting factors in the optics industry. The fundamental idea is to use supercomputers to synthesize a digital hologram which mimics the optical transfer function of a lens or lens system; and use lithography technology like that employed in the semiconductor industry to etch the hologram on a variety of materials. We have been applying the technology to producing optics for star trackers, for helmet mounted displays, as read-out optics for ring laser gyros; and for imaging optics for thermal weapons sights. In the latter application we developed a lens that focused all of the IR energy on the sensor pixels, and wasted none of the energy by imaging between or around the pixels. The effect was the same as a 2.5X effective increase in sensitivity, with a 40% optical weight reduction.

In addition we are working on new solid state lasers both for target acquisition laser radars and for counter-sensor weapons, microsensors based on lithography techniques which we will use to try to improve significantly the reliability of electromechanical, mechanical and hydraulic systems, e.g. on undersea vehicles; high definition large scale flat panel display for command and control applications among many others; and new antenna technology with application to OTH radars among others.

In short, we fund a set of high risk developments to provide a rich technology base needed to implement the military systems described earlier.

Support manufacturing technology

As lowering the cost of Defense is a major theme for DARPA, we are enthusiastic about our investment and our results in manufacturing technology and other acquisition technology, the third part of our investment along with military systems and high technology components.

As most of our manufacturing investment is in microelectronics production technology -- in recognition of the fact that in military systems the cost of electronics is approaching fifty percent of the total cost of the fielded systems -- I will concentrate my remarks there, but I want to note that we also have excellent programs in materials manufacturing, e.g. the metal matrix pilot line project, which should make economical the production of these structural materials for advanced aircraft and aircraft engines; the Lanxide system for inexpensive (4X reduction from prior methods) near net shape production of ceramic composites with application to advanced armor, and a number of others.

In microelectronics manufacturing we are trying to make available the special equipment and processes needed for low volume production of high performance components required by Defense. We are developing such equipment at Texas Instruments, as well as components for dry process lithography using 193 nm excimer lasers at Lincoln Laboratory and Perkin Elmer. One consequence of these developments is a significant reduction in the capital required for semiconductor production facilities. We expect to demonstrate a 0.35 micron facility at a cost of $30M rather than the $300M to $1B with current manufacturing technology. That spin-off benefit should help the entire semiconductor industry.

We are supporting the SEMATECH consortium in development of microelectronics manufacturing tools and processes for the near term, and in a related program developing x-ray lithography, and more generally sub-micron lithography, technology for the generation beyond SEMATECH's horizon. Both programs are on schedule, within budget, producing what was promised.

SEMATECH has already had major impacts on the industry. To give two examples: they supported a leading American manufacturer of lithography equipment to reduce the mean time between failures (MTBF) for their premier tool by a factor of two, and increased the throughput by a factor of two to three, including significantly reduced set-up time due to better alignment. For the first time it is practical to make 0.5 micron chips with American equipment. And they've worked with another equipment manufacturer to assure the American supply of very high speed mask making equipment, four times faster than the next best. This is the kind of equipment needed to sustain a robust ASIC (application specific integrated circuit) industry to exploit our strengths in chip design.

We are very proud of some of our recent accomplishments in the x-ray lithography program: the highest resolution printed using synchrotron x-ray exposure -- 60 nm features; the first gallium arsenide transistors produced using x-ray lithography; the most sensitive x-ray resist available in the defense industrial base, twice as sensitive as the next best, for greater throughput; the first laser plasma source available in the defense industrial base; the first commercial supply of x-ray masks, at 0.5 microns; the first commercial supplier of diamond substrates for x-ray masks; and much more.

In addition to digital electronics we have a significant investment in manufacturing technology for analog electronics. Our main programs are the MIMIC effort for microwave and millimeter wave monolithic integrated circuits and the infrared focal plane array program for reducing the cost of these advanced sensors in smart weapons and other military systems.

The MIMIC program is achieving impressive results. The cost of MIMIC chips has been reduced from \$20/mm^2 to \$3-8/mm^2 . Advanced MIMIC CAD workstations are now commercially available. Eighty MIMIC chip designs have been completed, and half have been fabricated with yields as high as 93%. New metal matrix composite packages have been developed with a 10x cost advantage over conventional metal packages. Total test time for MIMIC modules has been cut from 95 minutes to 30 minutes. And there have been a number of MIMIC insertions into weapons systems: 1200 MIMICs/month for HARM (high-speed anti-radiation missile) for example.

While just beginning, the infrared focal plane array (IRFPA) producibility effort has already achieved good results. We have produced 488 x 512 platinum silicide arrays, 480 x 4 mercury cadmium telluride (MCT) arrays, and 64 x 64 mercury cadmium telluride arrays as the first step toward manufacturing refinement. And perhaps best we've made significant advances in MOCVD (metal organic chemical vapor deposition) of thin films of mercury cadmium telluride on gallium arsenide substrates, the first 64x64 ten micron arrays on that substrate, opening the way to applying the successful semiconductor production techniques used in making digital chips to these sensors.

For the longer term, we believe that a highly promising approach to affordable production of MCT IRFPAs is molecular beam epitaxy (MBE). DARPA has pioneered the research in this field, supporting its development at several universities. The success of this effort has led to the establishment of MBE facilities in the development laboratories of all of the major IRFPA manufacturers. In addition, USA, NVEOL (Ft. Belvoir) is setting up a large in-house facility for MBE of MCT.

Finally, there are two other areas that continue to receive considerable national attention and in which DARPA in making important technical contributions. These are counter-drug/counter-terrorism/low intensity conflict and nuclear test monitoring. In both of these areas DARPA must reach out beyond our traditional DoD customers to fulfill Department responsibilities to a broad class of national security concerns and organizations.

Aid counter-narcotics, counter-terrorism and low intensity conflict

Much of DARPA's research program has some application in the areas of CN, CT and LIC. In addition we have a small investment in special tactical projects in surveillance and tracking, intelligence collection, detection, data fusion and analysis, and communications. I would prefer not to go into details on what we are building since we are working so closely with users and applications. The technologies we are building upon include both those pioneered by DARPA and other leading edge developments in the national technology base: infrared, acoustic, radar, and laser radar sensors; advanced signal processing algorithms and artificial intelligence; mass spectroscopy and neutron activation; advanced database technology; spread spectrum communications, high density microelectronics packaging, and encryption technology.

Monitor nuclear tests

While I have mentioned technology for monitoring arms control treaties in the context of INF, CFE and START, I have not yet mentioned DARPA's main investment in this area, namely our nuclear test detection technology.

This program conducts research to enhance U.S. capabilities for monitoring nuclear explosions on a global basis and provides technical support for the DoD in ongoing negotiations on nuclear testing. The program also conducts research on methods for accurately detecting and characterizing radiation from nuclear sources.

New methods for estimating the yields of large Soviet nuclear explosions have been developed and incorporated into the U.S. operational system for monitoring the current yield threshold. These new methods, which have incorporated the results from the U.S.-U.S.S.R. joint verification experiment, significantly increase the accuracy of these estimates.

Our experimental high frequency array demonstration program is now collecting data from three arrays along the periphery of the Soviet Union and has already shown a factor of 10 improvement in the detection of seismic events in the Soviet Union. The processing of data from these advanced arrays incorporates the latest artificial intelligence techniques.

This year as part of our program to provide the required technical support to the Conference on Disarmament we began large scale test of components of a proposed international seismic data exchange system. An experimental international data center has been established in Washington, with direct wideband computer links to other centers in Stockholm, Canberra, and Moscow and stations in a large number of countries. This test is the largest and most complex technical undertaking of any multilateral monitoring proposal thus far.

In addition, we have field tested an extremely sensitive gamma ray spectrometer and imaging device and have demonstrated the capability to detect and identify nuclear materials at a distance.

In summary

If DARPA's long range plan is sustained over the next five years the Department and the Military Services will have the option of military systems in the inventory that would otherwise not be available. These military systems can form the basis for a rational response to the changes in Eastern Europe, the decline in the Defense budget, the increased sophisticated weaponry in Third World countries, the emerging DoD role in counter-narcotics, the globalization of defense and dual-use technology, and new responsibilities to monitor arms control treaties.

What could be in that inventory as a consequence of DARPA's program?

- A new generation of systems to find and identify enemy air, land and undersea platforms despite aggressive CCD, denial and countermeasures.

- A corresponding new generation of survivable platforms, including submarines, to deny targeting information to our adversaries.

- Automated battle management and battle planning systems, supported by automated imagery and signals analysis capabilities, survivable space systems, survivable gigabit communications systems and submarine-laser communications.

- Multi-Service all echelon allies' simulation and gaming systems for distributed training.

- Survivable, high efficiency smart weapons including smart networks of air deployable mines

And since we are unlikely to predict what we really need -- just look at the events of the last few months -- we should have the high performance technology components to build other military systems than those listed just above. We can have:

- Trillion-operations-per-second supercomputers and billion-operations-per-second portable supercomputers.

-Billion-bits-per-second packet switched networks.

-Artificial intelligence systems technology with automatic learning for improved performance.

-Software libraries for reusing programs rather than always writing new ones.

-Large flat panel high definition displays.

-Small, inexpensive guidance packages with high accuracy world wide.

-Microelectronics manufacturing technology for low volume, high performance rapid prototyping of semiconductor components for Defense.

We are excited about our strategic directions and long range plan. We believe we have integrated our military systems, high technology and manufacturing technology investments into a coherent whole. In the last year we have gotten exciting technical results from our programs and effected significant technology transitions. I am personally pleased that we have been able to strengthen our technical staff of scientist-manager-entrepreneurs. And we hope the Congress will continue to support the Agency with the same enthusiasm as in the past.

EXPLANATION OF HARDWARE DEMONSTRATION EXHIBITS

Mr. **Murtha**. Explain the hardware that you have here for the Members.

Dr. **Fields**. I am pleased to do that.

We have brought with us today several things. One is this anti-helicopter mine, air deployable. This doesn't have explosives in it because we didn't want to bring an acoustically activated real mine into the hearing room, but when activated it can either shoot at helicopters within a ——— meter range, or force them to fly high and thus be vulnerable to other forces.

We have a real UHF communications satellite for voice communication. This and a number of others are being launched later this year; take off the plexiglass, put on metal, take off the stand, take off the ribbon, and this is going to fly and be used and be applicable to tactical commanders.

I have a real supercomputer that operates at about a billion arithmetic operations per second, about the same as a Cray, the size of two large refrigerators.

It is that silver thing below. The black thing is the fan. The predecessor of this particular supercomputer is a little larger than it is today at sea on the ——— the only supercomputer on any submarine that I know of, because all the others are too big. So I brought that along.

I have the world's highest power density and energy density battery, a lithium battery based on some new, thin film technology. The noteworthy thing about this battery, which is needed to power mines and things like that, is how robust it is. You can drive nails through it or cut it in half or heat it up to the smoking point and it keeps working. That is the kind of thing DOD needs.

I brought some ceramic applique armor which can be applied or taken off a tank and repaired with an attachment that is like Velcro, finally a mass use for Velcro. The armor itself is a ceramic armor that is an outgrowth of a process at a company called Lanxide. We have reduced the cost 400 percent.

I brought a piece of intelligence gear—I can't talk about what it was meant to do. It is an amplifier, but the point is after they built it, they couldn't use it because it was too big. Se we in our packaging program for microelectronics made it small and this is the current size of it. This gear is now around the world actually collecting sensitive intelligence data. Without us, it wouldn't have happened.

I brought some optics. You have heard a lot about the decline of the U.S. optics industry, the difficulty of getting special glasses and special grinding equipment. We invented a new kind at Lincoln Laboratory which uses plain old, cheap glass and no grinding equipment at all, and you print on the surface a pattern, a hologram, which mimics an optical system which doesn't exist and can be used to produce the equivalent of optical systems you can't build because no glass has the right properties. These are now getting into production in night vision devices and star trackers on weapon systems, et cetera. It can lead to a revival of the industry.

I brought come ceramics packaging. This came out of the same company that did the armor. U.S. companies are completely out of the ceramic micro-electronics packaging area. We are totally dependent on Japanese sources, in fact, in many cases one Japanese source, Kyocera and now as an offshoot of the armor, we are back in the ceramics packaging business with better ceramic packaging than you can buy abroad. So I am pretty excited about that.

Mr. MURTHA. Did you say this is an actual satellite that you brought along? You take the stand away, you cover the plexiglass, and replace it with a metal cover? You mentioned before we started the hearing that you were able to show that you could build these much cheaper than some of the military models. Would you explain what you meant there?

Dr. FIELDS. This is DARPA's second light satellite. The first was launched two years ago, and cost us $800,000. We did it in less than a year. It was also on the shuttle. It was a communication satellite as well. What we did was to employ commercial parts and commercial production practices. Instead of having 150 pounds of documentation per pound of satellite, we had a lot less. I am not saying that this is the technology that you should employ for all U.S. space systems. That is wrong. Some require MILSPEC, but some don't. We are trying to broaden the opportunities available to the space community through this technology.

Mr. MURTHA. What would be the difference in cost between this and a military satellite of the same size with the same mission?

Dr. FIELDS. There are no military satellites with the same size and the same mission, so I can't give you a comparison. This is a couple hundred thousand dollars.

Mr. MURTHA. Mr. McDade.

Mr. MCDADE. Thank you very much, Mr. Chairman.

Welcome and we are delighted to have you here, Dr. Fields. What is the object on your right?

Dr. FIELDS. That is an anti-helicopter mine. It forces helicopters to fly at higher altitude so that they are vulnerable to traditional weapon systems or it shoots them down if they fly at low altitude. This is an air-deployable mine that you would put on ridges or in valleys.

Mr. MCDADE. How does it discriminate between good guys, bad guys?

Dr. FIELDS. This is acoustically activated and the sound signatures are different. They have different numbers of blades and rotate differently. That is how it differentiates.

Mr. MCDADE. That is a COMSAT?

Dr. FIELDS. Yes.

Mr. MCDADE. You said it costs $800,000 using existing off-the-shelf commercially available hardware?

Dr. FIELDS. That was the one we launched. This one is actually somewhat cheaper than that.

Mr. MCDADE. What system does it duplicate?

You are showing us a satellite and you have talked to the chairman about being careful about trying to say one satellite does everything, and we understand that—what is the version that is up there? What does it do and what does this do and what is the difference in cost?

Dr. FIELDS. There really isn't a comparable function. I can't give you a one-for-one comparison that makes sense.

There is no apples to apples.

Mr. McDade. We couldn't say, for example, we are looking to save some money, we want to put this up and it only costs $800,000 or less to replace?

Dr. Fields. Not this particular satellite.

Mr. McDade. What does it do?

Dr. Fields. It does two kinds of things.

It provides voice traffic or record traffic for tactical commanders; something you can put up fast in unconventional orbits to deal with regional conflicts. Also, it orbits the globe and picks up data from sensors, so it is a data relay in that sense.

Mr. McDade. So you are saying that you could use it for tactical applications, voice transmission?

Dr. Fields. Yes.

Mr. McDade. You could use it for data transmission in sonobuoys, things of that nature?

Dr. Fields. Yes.

Mr. McDade. Any other applications?

Dr. Fields. Those are the two obvious ones. I am raising those because the Navy is buying a predecessor in some quantity for a real Navy application, so we have had some real technology transfer.

Mr. McDade. Sonobouy sensor system?

Dr. Fields. That is right.

ADVANCED SUBMARINE TECHNOLOGY

Mr. McDade. That is very interesting.

Let me ask you about advanced submarine technology.

Three years ago, we began to fund your research program because of our dissatisfaction with the Navy's commitment to the "leap ahead" technologies. So far, we have appropriated over $300 million to DARPA. Tell us, please, the general areas of research being addressed with the $300 million.

Dr. Fields. The best way to think about our program and a way that covers 70 percent of the program is that we are trying to make stealthy submarines, trying to do for submarines in the 1990s what we did for airplanes in the 1970s. We are dealing with structural acoustics, with shaping, with materials, with active measures.

In doing those things, we have to do underlying technology, for example, by producing a particular shape for a submarine, that may be optimal for a submarine from an acoustic point of view, current propulsion systems won't fit inside, so we are also doing work in propulsion. We are doing work in propulsors in order to reduce the amount of noise generated by submarines. There is a whole range of things which are in our submarine technology report that we sent to this committee.

Mr. McDade. With three years of effort, it is pretty serious in terms of the money we appropriated. What is DARPA bringing to the table that wouldn't be there if we hadn't invested the money?

Dr. Fields. What we always do, competitive management with U.S. industry focus and direction. We try to get results, build prototypes, and get them into use. The program is very successful. We are getting lots of results and we have a very good transition plan now in operation with the Navy. That transition plan also was submitted to this committee, so that as results come out of the program on a year-by-year basis, we know what results are going where. Some go into further R&D, some can be applied to upgrading SSN-688's or Tridents, some can be applied to either the SSN-21 or later.

Mr. McDADE. I would like to ask you to give us, in your judgment, the highlights of what you have brought to the table. I recognize that we have reports going back and forth, but could you describe to the committee—because it is a matter that we have invested in heavily—and I would like to have highlights of what is there now that wouldn't be there if we hadn't made this decision and invested this money.

Dr. FIELDS. Let me give you one example.

We have investigated and determined some new shapes for submarines that make 10 to 20 decibel difference in their active cross section. One of the threats we have to face now that we didn't have to face in the past was active acoustics, underwater radar. We have to do the same kind of shaping for submarines that we thought about in a totally different regime for airplanes.

So we have investigated a whole set of shapes and the structures that you can employ in order to actually build submarines like that and the materials that you can put on the surface to absorb the acoustic radiation and the active measures you can use to cancel out the impinging acoustic radiation and the sensors that we would embed in the composites that would form new hulls in order to act as a smart skin to sense the impinging acoustic radiation and then generate the negative return to cancel it out. That is some of the most exciting work in the program.

Mr. McDADE. Was this an area that is new territory? The Navy was not involved in that?

Dr. FIELDS. Yes.

ADVANCED SUBMARINE TECHNOLOGY FUNDING

Mr. McDADE. Of the $300 million appropriated to DARPA, how much has been obligated? Put that in the record.

[The information follows:]

$259 million has been obligated.

Mr. McDADE. How much is in the budget this year for this level of effort?

Dr. FIELDS. Ninety-five million dollars appropriated in fiscal year 1990, $95 million appropriated in fiscal year 1989, and $112 million appropriated in fiscal year 1988.

Most of the money is obligated, but we are behind in expenditures because it was sort of a step function of funding. No question that our expenditure record could be better.

Mr. McDADE. Is there any money in the budget for this purpose? We have always added this.

Dr. FIELDS. There are zero dollars requested in fiscal year 1991.

Mr. McDADE. No budget request at all?

Dr. FIELDS. No.

Mr. McDade. That leads me to have to ask you to be very definitive about where you are between obligation rates and expenditure rates because we are having a terrible year.

If you have this level of effort going back and forth with the Navy, why is there nothing in the budget? If it is so good and you are bringing to the table the kinds of things we talked about which are so important, why is there nothing in the budget?

Dr. Fields. I can't answer that question.

Mr. McDade. Has the Navy made a request to OMB or OSD to continue the research?

Dr. Fields. I made a request and that request was not given a positive answer. You will have to ask up the chain as to the reason.

For fiscal year 1992, however, we have been given our first fiscal year 1992 guidance and in fiscal year 1992, we have definitely budgeted in that fiscal year, and I understand the Navy has in that fiscal year, but I, of course, haven't seen their figures.

Mr. McDade. We had a plan originally, a three or four-year level of effort that the Congress was initiating and there is a gap in the plan in fiscal year 1991.

Dr. Fields. There is a 1991 gap.

Mr. McDade. Everybody would say we could have spent the money more efficiently. Are you saying there are no carryovers there that will bring you through the gap? Define that number for us, because I can't remember where we were thinking about being in terms of level of effort and you are at a zero level this year and you have a gap until 1992. Try to get a number that would be required to get you to a good level of effort, recapturing, if we can, money that is in the table.

Dr. Fields. Okay.

Mr. McDade. Thank you, Mr. Chairman.

[The information follows:]

The administration, after evaluating and prioritizing competing requirements, could not justify funding the Advanced Submarine Technology Program.

Mr. Murtha. Mr. AuCoin?

CIVILIAN RESEARCH AGENCY

Mr. AuCoin. Thank you, Mr. Chairman.

Dr. Fields, delighted to see you again. It is always a pleasure to have you come before our committee. It has been a pleasure to work with you through the years.

I would call to the attention of the committee the fact that DARPA is the agency that pioneered the technology for the Tank Breaker infantry anti-armor weapon, Mr. Chairman, the one that is well known as being this gentleman's favorite Army weapon system. It was a DARPA project, and now is soon to be in the hands of the infantrymen; I think DARPA deserves great credit for the work that it did. It sometimes occurs to me that the country really pays a severe price for not having a civilian counterpart to your agency, Dr. Fields, and I know that some of the work that you do has a commercial spinoff. But as we head into the world of the nineties, in which the United States and all other countries are going to have increasing reason to be concerned about economic matters and decreasing reason for concern about military matters, I wonder what a Civilian Advanced Research Projects Agency might do for this country.

I am sure you have given this matter some thought, if only in your spare time such as that may be. Could you share those thoughts with us, though they may be purely private and personal opinions? Would a civilian agency be a good or bad idea?

Dr. **Fields**. Let me deal with it substantively.

About half of DARPA's budget is in so-called dual-use technology, technology that is done to commercial spec in the areas of supercomputers, software, artificial intelligence, materials. A civilian agency engaged in the same pursuits would do nothing different and would have no value as long as those pursuits continued. However, there are two kinds of things that my agency can't do within its current charter, and those are the gaps that a civilian agency might fill. Number one, there are whole technology areas that we really shouldn't engage in, and we don't. We do nothing in consumer electronics. We do nothing in the area of education for lower grades. We do nothing for agriculture. We do nothing in medicine with one or two tiny exceptions that are unique to the military. Those are just gaps. The second issue is application. When we develop materials, we apply them to armored vehicles, not automobiles. So the whole area of applying fundamental technology to products that are non-military is something we shouldn't do and don't do, and that could be done by a civilian agency. A reasonable question is, could it work? There are two aspects. One is bureaucratic and the other is what I will call trade.

The bureaucratic aspects are just hiring good people and having a budget and freeing it from bureaucracy. We are very fortunate in not being mired down in bureaucracy. I want to keep it that way.

The other issue is technology alone, which is inadequate for industrial success. You have to have fair market access and a good financial plan, and somebody has to supply those. That is the context in which I would answer.

Mr. **AuCoin**. Is it your opinion that a civilian agency would, of necessity, have to be large in bureaucracy or could it be lean and mean and still be effective?

Dr. **Fields**. I think that it can't be effective if it is large.

Mr. **AuCoin**. But it can be if it is small with freedom to explore and to discover?

Dr. **Fields**. That is absolutely necessary.

Mr. **AuCoin**. Do you have any thoughts on areas it should concentrate on first given the state of the economy as a whole in the country?

Dr. **Fields**. Well, if you are dealing with this as a matter of national economy, look at our trade deficit, and there is one area that is larger than all others, the automobile industry.

There is a lot of technology there that can be dealt with.

HIGH DEFINITION TELEVISION

Mr. **AuCoin**. HDTV is a big concern of mine and I know it is a big concern of yours. The only work being done in HDTV is DARPA in terms of the Federal Government. I think that is a big mistake, Mr. Chairman. HDTV, as I understand it—and Dr. Fields can indicate whether I am correct or not—HDTV is not just a question of bright picture tubes that people can watch "Mork and Mindy" on across the country. Instead, HDTV technology is a cluster of technologies that are critical across the spectrum of our industrial base, and that is point 1.

Point 2 is it is my impression that we are in a very real race with the Japanese in mastering and being masters of this technology and being able to market it and to bring it into play across these various industrial sectors. That is point 2.

Point 3 is, my impression is that that nation which moves out smartly, moves quickest, moves most successfully, is probably going to have a leg up in terms of critical technologies that have a lot to say about industrial success and a lot to say about technologies that have very direct military and national security applications in the future.

Are all three of those things true? Would you like to amplify on them?

Dr. **Fields**. I can amplify slightly because that is a very good summary.

HDTV is a misnomer because it means both a set of low-cost products, fax machines, personal computers, displays, and so on, and the components inside, the memory chips, flat panel displays, the processors, the power supplies, the recording devices.

Mr. **Murtha**. It is all electronic infrastructure?

Dr. **Fields**. Yes. It is the exact same parts that go into military systems, so the misnomer has been misleading and that is unfortunate. I would add one thing to your comment about competition with Japan. It is not competition with Japan. It is competition with Japan, with France, with Germany, with Great Britain. If you have read any of the CIA reports on the subject, it is hard to identify any industrial nation that doesn't have a national program in this area.

Mr. **AuCoin**. Describe what our program is as a country today.

Dr. **Fields**. The only activity I know of is DARPA's investment in flat panel displays which are consistent with commercial specs and investment much smaller in the special chips for image compression and architectures for image processing. So it is a very, very small enterprise.

Mr. **AuCoin**. What are the dollar amounts?

Dr. **Fields**. Our total investment requested is $30 million, spent over 36 months, but spread over 4 fiscal years, $5 million in fiscal year 1989, $10 million in fiscal year 1990, $12 million in fiscal year 1991 requested, and an expected request of $3 million in fiscal year 1992.

Mr. **AuCoin**. How does that compare with the most aggressive of our foreign competitors? I suppose that would be Japan. Do you have comparable figures?

Dr. **Fields**. Government investment abroad ranges from half a billion dollars to a billion dollars.

Mr. **AuCoin**. Mr. Chairman, I think this is one of the most significant issues this country has to face and DARPA is the only agency that I can see in the entire Federal Government that is doing anything on it and the budget that it has been given is woefully small compared to what we see happening around the world on the part of nations that are in direct competition with us and the consequences here are not just—do not just apply to the commercial industrial sector.

They have significant national security implications.

Mr. MURTHA. I agree with the gentleman and I met with Dr. Fields earlier and asked him for DoD to give me some proposals, that we could look at and see if we coundn't do something about it.

I think this is really on the edge of technology and if we don't get into the research game now, we are going to be out of it completely in this field. It is so basic, and it is essential to our national security If DoD comes up with a program, we will see what we can do. I am sure the committee would support a lot more money in this field.

STRATEGIC DEFENSE INITIATIVE

Mr. AUCOIN. I appreciate that, Mr. Chairman.

I want to move to SDI, if I could for a brief question. I will have more, but I will do it on the second round of questioning.

Dr. Fields, I have recently spent, a number of days moving around the country at our chairman's request looking at various SDI weaspons labs and contractors and trying to ascertain the work that is being done at these various locations, and I was impressed by the quality of the work that they are doing.

That is separate from my own view of whether SDI is stabilizing or not, but at the same time, I was struck by a number of Red Team type issues that seem to me to not be adquately addressed, and I have deep misgivings based on what I have seen about the validity of the Red Team exercises being directed by people who, in my judgment at the bottom line, seem to have an interest in their own team's failure, the Red Team's failure, and I think if SDI is going to be given a rigorous test, we need rigor in the red team technologies being considered.

Suppose we were to assign some or much or all of the SDI red team work to DARPA, is there any reason DARPA could not handle that mission?

Dr. FIELDS. There is no technical reason, but we wouldn't seek the opportunity.

Mr. AUCOIN. Would not?

Dr. FIELDS. The fundamental reason is the following. SDI was established in 1983. It began as a spinoff in part from DARPA. There were charged particle beams, X-ray lasers, kinetic weapons from the ground and from space, X-ray lasers, smart pebbles: one per fiscal year.

Mr. AUCOIN. One pebble per year?

Dr. FIELDS. One such major idea per year. Either you trust these guys or you don't trust them to execute the program. If you don't trust them, having someone else perform them is not effective. If you trust them, trust them. While we could execute such a mission, I really wouldn't seek to perform that type of activity.

Mr. AUCOIN. Well, Mr. Chairman, could I go a little bit further on this?

HIGH DEFINITION TELEVISION

Mr. **Murtha**. Let me ask back on HDTV—how do we get the rest of the government to understand the importance of this research? Let's say you come up with a program and we put substantially more money into it next year. How do we get OMB and people like that to understand the importance of the research and the commercial application and how do we get those folks interested? Does that come after the research or there is just a natural application?

Dr. **Fields**. I think it is going to take a lot more education of people who are fundamentally not technical. The National Advisory Committee on Semiconductors came out positive about this general area. That is a commission that was chartered by the Congress to report to the Congress. I spent a lot of time with the President's Science and Technology Advisor and he understands. It takes some time. The problem is you don't want to fall behind during the education process.

Mr. **Murtha**. Mr. AuCoin?

STRATEGIC DEFENSE INITIATIVE

Mr. **AuCoin**. Mr. Chairman, just coming back to this in-house SDI red team thing, to me it is not a question of trusting. It is a question of—let me put it this way. If there were a Red Team leader or a Red Team official who had as his task testing something out and he came to the conclusion that a system is not going to work, it is just flat not going to work, it would seem to me the chances are considerable that that person would have his idea suppressed or would be certainly not welcome to bring that idea forward.

If, on the other hand, red team work was done by another agency, DARPA, which does not have as its task the bringing forward of various technologies, it would seem to me that you would avoid that problem. It is not a question of trust. It is a question of checks and balances.

Dr. **Fields**. It is possible to have checks and balances within an agency. In DARPA, the question of measuring countermeasure red team goes on every day and there are many things they investigate and they don't pan out.

Mr. **AuCoin**. I am reminded of the B-1 program, a program that came back and bit a lot of its advocates in a place that really hurts. There were lots of red team exercises in the B-1, too, and we saw the result. You have indicated that DARPA would be capable of doing this kind of work, it is nothing inherently in your organization that would make you incapable of doing this work?

Dr. **Fields**. Capability is not the issue.

Mr. **AuCoin**. What is your assessment of SDI's technology for critiquing objectively the critical issues of cost effectiveness of the margin and survivability, particularly the countermeasures questions?

Dr. **Fields**. I would rather not comment on that at this time, if you would indulge me.

Mr. **AuCoin**. Do you have a technical capability in those regards?

Dr. **Fields**. Yes, we do.

Mr. AuCoin. Mr. Chairman, I will save my questions for the second round.

Thank you.

Mr. Murtha. Mr. Miller?

STEALTH PAINT

Mr. Miller. Thank you, Mr. Chairman.

Dr. Fields, we are glad that you are here with us. We need all the information we can possibly get. There was a question that I had about the 1990 Appropriations bill. This committee provided $1 million to DARPA to help develop a radar-absorbing paint. This is the stealth paint. I supposed that we can talk about that in this committee. The hearing is closed. I understand that you have been working on that with Carolina Solvents. What is the status of the project right now?

Dr. Fields. The company has a contract. They are at work doing a set of evaluations on the limits of the technology. We will be getting the results in a time scale of months. We are excited about the idea. To be direct about it, had they come to us with a proposal, it is such a good idea we would have been pleased to find the funds independently of the committee because it is very good work. If more funds are needed to continue in fiscal year 1991 and it looks as exciting then as it does now, we will continue.

Mr. Miller. The company is concerned about the fact that they have received $200,000 and that is a small amount I understand from what they have already spent.

Dr. Fields. My understanding is that we had given them a contract for a million dollars, not $200,000. I now understand the issue is that we wanted to give them as fast a start as possible; thus we gave them a letter contract to start. Under the provisions of such a letter contract, you only give them a fraction of the money and we are following up with a formal contract thereafter. This way they can start spending quickly and not wait. We are giving them the full million dollars without question.

TECHNOLOGY TRANSFER

Mr. Miller. Another concern that we have is technology transfer. I was looking through your remarks, and notice we are working with an international technology group, and that seems as though that we could be transfering our technology to many different countries. You list the items that you are working on, and also the countries that were involved (Federal Republic of Germany and France and the United Kingdom). So will they have all of the information that we have on these particular items?

Dr. Fields. No, not at all. In fact, let me say that each case is examined on its own merits because there are several sides. On one hand, we want cooperative development to share costs and to assure commonality with our allies and there are places we want technological supremacy, so each case we look at individually. All cases were involving military systems and not fundamental technology of say, ceramics or electronics. On those we would have to look even more carefully.

BATTERY TECHNOLOGY

Mr. Miller. There was another item that we had, $1 million—I know that is a small amount compared to your overall budget—for battery technology.

We are still using the same battery—I have mentioned it several times—that Henry Ford used, lead alkaline or lead acid battery. We do not have electric storage that is so important. I don't know whether we are giving much thought to the importance of an improved electric storage system. Are you doing anything at the present time that would help us in this way?

Dr. Fields. Yes. We have a very, very high-quality power sources program looking both at batteries, chargeable and non-rechargeable, and looking at solid state fuel cells that use ceramics as their main structural element and we are getting excellent results and even transferring them, because the fuel cells will be used as the power source for unmanned underwater vehicles that we are building in another part of the agency.

I had illustrated earlier with this battery, which is about the same power as your much larger and heavier automobile battery. So I completely agree with you and we are doing as much as we can.

Mr. Miller. Very good. Thank you, Dr. Fields. Thank you, Mr. Chairman.

Mr. Murtha. Mr. Livingston.

STRATEGIC DEFENSE INITIATIVE

Mr. Livingston. Thank you, Mr. Chairman. Welcome, Dr. Fields.

Following up on Mr. AuCoin's questions, Dr. Fields, if DARPA did the red team effort of SDI, to what extent would that divert your energies from other activities?

Dr. Fields. If we did it without additional personnel and financial resources, it would be really a disaster. We would have to add people and it would take money because I wouldn't do it unless we could do a high-quality job and until this moment I never gave a thought to scoping the issue and I can't do it on the spot.

Mr. Livingston. Do you feel you could do it more economically or would it be more expensive for DARPA to do it as opposed to having a SDIO red team?

Dr. Fields. I don't think cost would be a discriminating factor one way or the other.

Mr. Livingston. It is just a matter of who does it?

Dr. Fields. I think that is the issue.

Mr. Livingston. Have you formulated any opinion about the current technology in SDIO?

Dr. Fields. Yes, but I would rather not comment on their work.

Mr. Livingston. Your current role in SDI development, I take it, is low then?

Dr. Fields. Yes. We have no joint projects with SDI at this time.

Mr. Livingston. Any applications that might be ultimately turned over to them for development?

Dr. Fields. Yes.

They are employing a lot of our technology. We view them as customers in supercomputing, space technology, power sources, electronics, et cetera, but not through joint programs.

Mr. LIVINGSTON. So as you develop things in which they might be interested, there is a coordination factor which enables you to turn it over?

Dr. FIELDS. Absolutely and many ex-DARPA employees work there.

HIGH POWER MICROWAVE RESEARCH

Mr. LIVINGSTON. With respect to the services and SDIO's work on high-power microwave HPM or other directed energy weapon concepts, what work is DARPA doing in this field and why?

Dr. FIELDS. We are doing rather different work from the services, as we should. The services have very robust programs in high-powered microwaves. We decided we were going to try to do surgery with a scalpel rather than a machete, so we are doing work in medium power microwaves, much smaller devices, much lower cost, much lower power. The way they can be effective is by carefully tailoring the signal to match the characteristics of the things we are going against. Last year we had a great success with a device from Physics International, orders of magnitude smaller than what you have to do with a high-powered approach, and yet could burn out communication gear. So it is quite different in its approach.

We are involved in producing battlefield lasers and counterlaser technology, the measure/countermeasure theme. We are trying to do solid state lasers for the battlefield that are light-weight, 300 to 350 pounds, about a kilowatt, that can be used as countersensor weapons. The other side is the sensor protection where we have some really interesting ideas that are just starting to work now, in fact, ideas that employ technology like this optics technology that I showed earlier. We tailor the optics to the threats.

Mr. LIVINGSTON. How does DARPA's program differ in these areas from other services?

Are you at the forefront of the technological development?

Dr. FIELDS. That is our job and we try to stay there.

Mr. LIVINGSTON. With respect to these particular programs, high-powered microwaves, lasers and other directed energy weapons concepts, how much money is requested for fiscal year 1991 and how will these funds be used?

Dr. FIELDS. I would like to give exact figures for the record.

We are making particular experiments in lasers in order to deal with heat dispersion issues because when you get that much power in a small volume, you don't want it to melt. We have some ideas there. In medium-power microwaves, we are doing further testing and looking at the countermeasures because if you have simple countermeasures, we are going to stop the program. It is not worth doing.

[The information follows:]

The total amount requested for Directed Energy Weapons for fiscal year 1991 is $48.266 million. The breakdown from the congressional submission is:

Project number and title:	Fiscal year 1991 (millions)
ST-12—Adv Quantum Electro-optic	$19.165
TT-06—Tactical Directed Energy Tech	14.601
PB-01—Particle Beam Tech	14.500
Total	48.266

Mr. **Livingston**. You are keeping an eye on the other services in order to coordinate this activity?

Dr. **Fields**. Absolutely.

Mr. **Livingston**. Thank you.

Thank you very much, Mr. Chairman. I will have other questions for the record.

[**Clerk's note.**—Questions submitted by Mr. Livingston and the answers thereto follow:]

SHORTAGE OF SCIENTISTS

Question. Dr. Fields, the National Science Foundation projects a shortfall of 560,000 scientists and engineers by 2010. Can you tell this Subcommittee how this human resource shortage impacts DARPA's research programs, labs, and more specifically, your fundamental research (6.1 account) programs?

Answer. Despite salary and ethics legislation restrictions that impact the number of scientists and engineers available to the public sector, we at DARPA have been fortunate to successfully fill our vacancies with the very best people. While we attribute some of our success to DARPA's reputation for excellence, I would also point out that every one of our managers is constantly on the search for outstanding candidates, and all of us spend a significant amount of time in recruiting.

Question. Please quantify for the record what shortages DARPA is experiencing in acquiring science and engineering graduate talent.

Answer. As stated above, while we are aware of these shortages, we have not experienced a significant shortfall.

Question. What specific programs does DARPA have to address shortfalls in scientific and engineering personnel? Provide a breakout of programs by account and dollars as well as a brief explanation of each program.

Answer. We do not have specific programs with this goal.

FELLOWSHIPS

Question. Does DARPA have graduate traineeship or fellowship programs for science and engineering? If so, provide details on funding and accounts that these programs fall under. If not, explain why.

Answer. We do have a fellowship program sponsored in part through our Defense Sciences Office that has gotten off to a very good start. DARPA selected 22 students in FY 1989 at a cost of $1.163 million and 13 students in FY 1990 ($1.20 million). DARPA chose mathematics, materials, manufacturing sciences, electrical engineering, and chemical engineering as areas to fund in FY 1990. Additionally, through our sponsorship or work at a large number of this nation's universities, we are indirectly sponsoring graduate work in all of the technology areas of interest to us.

Question. Provide for the record a breakdwon by state, university, number and dollars the fellowships in science, engineering, and other areas that DARPA has provided in each of the last five fiscal years.

Answer. Because the program was only initiated last year and 1990 figures have not been tallied yet, only statistics for 1989 are available. DARPA funded 22 students at 12 schools in 9 states. The detailed breakdown is as follows:

State and schools:
MA: MIT (4).
GA: Emory.
NJ: Princeton.
CA: Berkeley (4), Stanford (2), UCSB.
IL: Northwestern (2), Illinois Inst. of Tech.
TX: University of Texas.
NC: NCSU (3).
PA: Penn State.
NY: RPI.

All of the fellowships were for the same amount:
$6,000—tuition reimbursement.
$1,000—school administrative costs.
$1,667—to student directly.

Question. If additional funding were made available to DARPA, would it make sense and be helpful to future DARPA research efforts to implement graduate science and engineering traineeship programs that would develop a broader national base for science and engineering talent?

Answer. While we certainly support any efforts towards enhancing this nation's educational system, if funding were made available to DARPA, it would be better spent on specific program activities that would in turn effectively employ graduate science and engineering students and indirectly develop this talent base.

RESEARCH PROGRAMS

Question. Provide a breakout in number and dollar value, and by state and institution, the basic research or 6.1 program grants or awards made by DARPA to private or public entities for fiscal years 1987, 1988, and 1989.

Answer. See the following list.

PAGE 1 6.1 FUNDS BY STATE/INSTITUTION FOR FY 87,88,89

ST	INSTITUTION	FY87	FY88	FY89
AZ				
	ARIZONA STATE U	0.00	0.00	5,000.00
	U ARIZONA	100,000.00	140,000.00	46,000.00
	STATE TOTAL	100,000.00	140,000.00	51,000.00
CA				
	CALTECH	859,237.00	1,600,073.00	2,227,934.00
	SAN DIEGO STATE	0.00	79,899.00	348,826.00
	STANFORD U	3,861,541.11	6,092,675.00	5,095,295.00
	UC BERKELEY	2,900,000.00	3,301,225.00	1,389,225.00
	UC IRVINE	0.00	0.00	117,567.00
	UC LA	50,000.00	50,000.00	204,273.00
	UC SAN FRANCISC	0.00	81,663.00	50,000.00
	UC SANTA CRUZ	200,000.00	69,187.04	75,000.00
	UC SB	1,912,959.00	2,769,599.00	2,242,410.00
	UC SD	2,069,310.00	877,149.00	986,174.00
	USC	758,963.00	1,512,785.00	1,542,091.00
	USC ISI	1,579,975.00	3,467,104.00	5,036,841.00
	STATE TOTAL	14,191,985.11	19,901,359.04	19,315,636.00
CO				
	COLO ST U	75,000.00	385,471.00	260,723.00
	U COLO	0.00	0.00	205,205.00
	STATE TOTAL	75,000.00	385,471.00	465,928.00
CT				
	U CONNECTICUT	954,540.00	20,905.00	0.00
	YALE U	350,000.00	0.00	0.00
	STATE TOTAL	1,304,540.00	20,905.00	0.00
FL				
	U FLA	49,496.00	150,000.00	400,000.00
	STATE TOTAL	49,496.00	150,000.00	400,000.00
GA				
	GA INST TECH	0.00	0.00	113,998.00
	GEORGIA TECH	62,051.00	0.00	0.00
	STATE TOTAL	62,051.00	0.00	113,998.00
HI				
	U HAWAII	0.00	0.00	10,000.00
	STATE TOTAL	0.00	0.00	10,000.00
IL				
	U ILL	1,135,664.00	256,875.00	502,031.00
	STATE TOTAL	1,135,664.00	256,875.00	502,031.00

PAGE 2 6.1 FUNDS BY STATE/INSTITUTION FOR FY 87,88,89

ST	INSTITUTION	FY87	FY88	FY89
IN				
	PURDUE U	1,419,000.00	0.00	0.00
	STATE TOTAL	1,419,000.00	0.00	0.00
MA				
	BOSTON COLLEGE	50,000.00	47,781.00	0.00
	BOSTON U	251,749.00	0.00	265,948.00
	HARVARD U	109,190.00	325,000.00	205,195.00
	HEBREW UNIV	0.00	0.00	122,000.00
	MATS RES SOC	24,500.00	4,000.00	0.00
	MIT	7,575,359.00	4,475,824.00	5,240,699.00
	U MASS	468,000.00	0.00	216,000.00
	STATE TOTAL	8,478,798.00	4,852,605.00	6,049,842.00
MD				
	JOHNS HOP U APL	190,000.00	0.00	0.00
	U MARYLAND	453,000.00	626,208.00	391,158.00
	STATE TOTAL	643,000.00	626,208.00	391,158.00
MI				
	MICH STATE U	697,825.00	227,664.00	212,516.00
	U MICH	595,562.00	599,885.00	631,662.00
	WAYNE ST U	0.00	0.00	230,000.00
	STATE TOTAL	1,293,387.00	827,549.00	1,074,178.00
MN				
	U MINN	60,000.00	0.00	0.00
	STATE TOTAL	60,000.00	0.00	0.00
MO				
	ST LOUIS U	160,000.00	157,514.00	70,000.00
	STATE TOTAL	160,000.00	157,514.00	70,000.00
MS				
	MISS STATE	539,000.00	314,921.00	0.00
	U SO MISS	0.00	0.00	50,000.00
	STATE TOTAL	539,000.00	314,921.00	50,000.00
NC				
	DUKE U	0.00	52,593.00	260,000.00
	NC STATE	242,483.00	52,896.00	123,605.00
	U NO CAROLINA	114,041.00	600,213.00	530,057.00
	STATE TOTAL	356,524.00	705,702.00	913,662.00
NJ				
	PRINCETON U	230,200.00	348,048.00	512,568.00

PAGE 3 6.1 FUNDS BY STATE/INSTITUTION FOR FY 87,88,89

ST	INSTITUTION	FY87	FY88	FY89
	RUTGERS U	174,134.00	521,244.00	535,032.00
[redacted]	STATE TOTAL	404,334.00	869,292.00	1,047,600.00
NV				
	U NEV	50,000.00	43,720.00	128,000.00
	STATE TOTAL	50,000.00	43,720.00	128,000.00
NY				
	COLUMBIA U	1,134,422.00	64,288.00	257,000.00
	CORNELL U	43,400.00	0.00	233,312.00
	CUNY	0.00	0.00	751,277.00
	NY U	250,000.00	614,000.10	569,635.00
	RENSSELAER POLY	1,080,000.00	0.00	0.00
	STATE U NY	60,000.00	107,769.00	299,742.00
	U ROCHESTER	100,000.00	0.00	0.00
	STATE TOTAL	2,667,822.00	786,057.10	2,110,966.00
OH				
	CASE WEST RES	1,648,652.00	230,530.00	277,646.00
	OHIO ST U	1,299,257.00	0.00	442,180.00
	U OF CINCINNATI	0.00	0.00	502,869.00
	UDRI	0.00	159,327.00	0.00
	STATE TOTAL	2,947,909.00	389,857.00	1,222,695.00
OK				
	OKLAHOMA ST U	0.00	674,654.00	0.00
	STATE TOTAL	0.00	674,654.00	0.00
OR				
	OREGON GRD CTR	150,000.00	0.00	0.00
	STATE TOTAL	150,000.00	0.00	0.00
PA				
	CARNEGIE MELLON	2,618,716.00	1,796,365.00	4,003,092.00
	LEHIGH U	0.00	0.00	81,248.00
	PENN ST U	110,000.00	68,417.00	93,000.00
	U PA	1,424,000.00	214,803.00	570,000.00
	STATE TOTAL	4,152,716.00	2,079,585.00	4,747,340.00
RI				
	BROWN U	25,000.00	0.00	0.00
	STATE TOTAL	25,000.00	0.00	0.00
SC				
	CLEMSON U	0.00	0.00	50,000.00
	STATE TOTAL	0.00	0.00	50,000.00

6.1 FUNDS BY STATE/INSTITUTION FOR FY 87,88,89

ST	INSTITUTION	FY87	FY88	FY89
TX				
	N TEXAS STATE U	0.00	20,500.00	0.00
	SMU	2,225,000.00	301,790.00	185,000.00
	U TEXAS	426,277.00	372,553.00	0.00
	STATE TOTAL	2,651,277.00	694,843.00	185,000.00
UT				
	U UTAH	1,674,311.00	1,123,478.00	2,311,102.00
	STATE TOTAL	1,674,311.00	1,123,478.00	2,311,102.00
VA				
	U VA	0.00	0.00	125,000.00
	VPI	683,859.00	600,000.00	228,458.00
	STATE TOTAL	683,859.00	600,000.00	353,458.00
WA				
	U WASH	854,712.00	675,000.00	661,899.00
	STATE TOTAL	854,712.00	675,000.00	661,899.00
WI				
	U WISCONSIN	491,390.00	213,930.00	134,600.00
	STATE TOTAL	491,390.00	213,930.00	134,600.00
	AGENCY TOTAL	46,621,775.11	36,489,525.14	42,360,093.00

[CLERK'S NOTE.—End of questions submitted by Mr. Livingston.]

Mr. MURTHA. Mr. Sabo?

DRY DECK SHELTER PROGRAM

Mr. SABO. Thank you, Mr. Chairman.

A couple of questions, one relating to the ASW program, and in particular to what we call the dry deck shelter project which is an effort to develop composite materials for submarines.

How much 1990 funding has DARPA allocated to this project and do I understand correctly that the 1991 budget does not have funds for this program? What would be required in 1991 to continue it and how much will it take to complete?

Dr. FIELDS. Well, again, since the dry deck shelter is one of about a hundred projects in our SUBTECH program, I don't have the price of that one. We can supply that for the record. It is an excellent project. We want to continue it. The problem is the 1991 request for the whole program.

Mr. SABO. Supply for the record the moneys required for 1991.

[The information follows:]

Exploitation of thick section composite technology for submarine applications, for which the dry deck shelter is a candidate demonstration article, has been allocated $6.2 million of fiscal year 1990 funding. Future funding requirement will be established when future Advanced Submarine Technology Program budget authorizations are known and will depend on determination of this project's relative priority in the program.

Mr. SABO. It is a project with which you have no technical problems and in your judgment a good program?

Mr. FIELDS. It is a high-quality program.

NUCLEAR MONITORING

Mr. SABO. Let me switch to another question.

In most areas, DARPA receives high marks. I think all of us at least in my judgment, I think shared by most, think that this should be one of the highest priorities as we go through scale-back of funding.

In my judgment, the work of DARPA should not be scaled back. I have some concern over DARPA's following what Congress intended as it relates to a nuclear monitoring network. Last year, a certain amount of money was directed by Congress to the Eurasian Seismic Studies Program, with the understanding a certain minimum amount would go to a university group known as the Incorporated Research Institutions For Seismology, or IRIS.

The House authorization report mentioned $8 million. The Senate mentioned $6.5 million. When I visited with your staff, I was told that $7 million, which is a little more than the Senate, a little less than the House, was allocated to the IRIS program. However, since then I have received some information that this may or may not actually be the case because other projects had been added to the umbrella of what the House and the Senate were describing.

The scope of the project has been increased from what both the House and the Senate had in mnd and the original program has been squeezed from what was indicated in both the House and Senate reports.

Can you comment on that and provide for the record a breakdown of the budget for the nuclear monitoring programs and the Eurasian Seismic Studies Program (ESSP)?

Dr. FIELDS. I will look into it.

There was no mention of doing so. It is the highest quality work and if there was a mistake made, we will fix it. I would like to get those facts to you later.

[The information follows:]

The Eurasian Seismic Studies Program is being carried out under the 1972 Agreement Between the U.S. and the Soviet Union on Cooperation in Environmenal Protection. Under this agreement, the lead agency for the U.S. is the U.S. Geological Survey and the two principal investigators for carrying out the program represent the U.S. Geological Survey and the Incorporated Research Institutions for Seismology (IRIS). The ESSP agreement calls for a five year research program with specific projects to be undertaken on an annual basis. The Second Year Implementation Plan was developed and coordinated by all U.S. participants in December 1989 and discussed with the Soviets in January 1990. The final Second Year Implementation Plan was adopted by the U.S. program participants and forwarded to the Soviet side on February 5, 1990. Both the first and second year Implementation Plans are fully consistent with the overall ESSP agreement. All tasks in the second year Implementation Plan have been funded and work on all these tasks is proceeding on schedule.

The scope of the project has not changed in any way since the project was initiated. The primary focus of this program from the beginning has been the installation and testing of all high-performance seismic stations and arrays in the Soviet Union and the United States. DARPA funding support to this project in FY 1989 and FY 1990 has met or exceeded all Congressional requirements as specified in the National Defense Authorization Act for Fiscal Years 1990–1991.

The FY 1990 budget for the DARPA Nuclear Monitoring Program Element (PE 0602714E) is provided in Table 1.

The FY 1990 funding provided to the Eurasian Seismic Studies Program is provided in Table 2. The funding in this table is broken out by the agreed tasks in the Second Year Implementation Plan. This table also provides the initial funding, subject to availability, that is committed in FY 1991.

Table 1—DARPA Nuclear Monitoring Program element (0602714E) fiscal year 1990 funding

	(Thousands)
Development and Demonstration of Technology for Detection and Analysis of Low Yield Events in Eurasia	$8,284
Eurasian Seismic Studies Program	7,292
U.S. Activities in Conference on Disarmament Group of Scientific Experts	4,445
Support for Additional Participants in Conference on Disarmament, Group of Scientific Experts	4,406
Development of Discrimination Methods for Small Events	2,636
Development and Demonstration of Yield Estimation Methods to Low Yield	4,354
Advanced Test Site Characterization Techniques	1,032
Nuclear Radiation Methodologies	2,593
Total	35,042

Table 2—EURASIAN SEISMIC STUDIES PROGRAM FUNDING PROFILE

[Dollars in thousands]

Task area	Funding committed	
	FY 1990	FY 1991
Task 1A; Building & installation of stations in USSR for data exchange	2,296	1,500
Task 1B; Building & installation of stations in USA for data exchange	895	0
Task 2; Building & installation of arrays in USSR	1,070	0
Task 3A; Operations of stations, arrays & data centers	1,787	2,650
Task 3B; Equipment for data centers in USSR & USA	100	0
Task 4; Other projects (USSR visiting scientists, seismogram exchange, etc.)	509	335

Table 2—EURASIAN SEISMIC STUDIES PROGRAM FUNDING PROFILE—Continued

[Dollars in thousands]

Task area	Funding committed	
	FY 1990	FY 1991
Project management & overhead	635	580
Total funding level	7,292	5,070

Mr. SABO. The intent of both the House and the Senate was at least $6.5 million for the IRIS program. Our report is the funding may have been decreased.

Dr. FIELDS. We have no intention to disagree with the intent of the Congress.

Mr. SABO. Thank you. I have other questions for the record.

Thank you very much, Mr. Chairman.

[CLERK'S NOTE.—Questions submitted by Mr. Sabo and the answers thereto follow:]

LASER ASAT VERIFICATION RESEARCH

Question. Last year this committee added $2 million to fund a small-scale laser verification project to determine whether we would be able to verify the use of lasers as anti-satellite weapons, should the U.S. and Soviet Union negotiate a treaty to limit this technology. I was pleased to learn that you have devised a procedure to evaluate competitive proposals from three different national research laboratories.

Could you tell me when you intend to select a winner of this evaluation? Who will fabricate the prototype hardware? When do you plan to test the prototype? Is the $2 million appropriated in fiscal year 1990 sufficient to carry the project to completion? For example, how much will the tests cost? When will Congress receive a report on the results of the testing program?

Answer. DARPA made a $2 million award for a one-year program to a consortium of national laboratories for the proof-of-principle demonstration of technologies that could be used to verify future treaties which restrict the use of ground based lasers as anti-satellite (ASAT) weapons. The four national laboratories involved include: Los Alamos National Laboratory (LANL), Sandia National Laboratory (SNL), Lawrence Livermore National Laboratory (LLNL), and Argonne National Laboratory (ANL). The technologies will be tested at domestic sites and compared for accuracy with separate instruments and with current laser propagation and scattering computer code analysis. A Technical Steering Committee will be formed to review the program and assess the technology feasibility.

Question. I have an additional concern about the level of security classification for the project. While I understand that you may need to classify technical data on existing U.S. laser weapons, this technology ultimately could be used by both the United States and the Soviet Union in a cooperative verification effort.

How does DARPA intend to proceed with this project, given that the ultimate product must be not only unclassified but also exportable?

Answer. The existing High Energy Laser weapon security classification guide (DOD Instruction 5210.61) will be used to classify technical data on U.S. Laser weapons.

[CLERK'S NOTE.—End of questions submitted by Mr. Sabo.]

PERSIAN GULF ACTIVITIES

Mr. MURTHA. Let me ask one question. When DOD went to the Persian Gulf, you were given an assignment concerning the mine situation. What did DARPA develop there and how did you do that?

Dr. FIELDS. The how is a matter of business practice. What we did in a fairly fast reaction way was two things. One was to develop a helicopter-based laser system for searching out mines, a helicopter would fly ahead of a high-value asset like a tanker. The other was to use an off-the-shelf Canadian unmanned underwater vehicle remotely controlled and put on it a small, low-powered sonar that would swim ahead of a high-volume asset like a tanker. The critical issue was the speed of doing it. Since DARPA has so litle internal bureaucracy and paperwork, we are often called on to do quick reaction tasks. For example, we have been asked to do some very special things in the counternarcotics area recently. We were able from start to finish in months get equipment in the field in the hands of law enforcement officials.

That is an asset that I hope the Secretary of Defense will continue to deploy and value highly.

Mr. MURTHA. How many months in the Persian Gulf did it take from the time you were tasked to get this countermine measure in the field——

Dr. FIELDS. My recollection is we are talking about nine months.

Mr. MURTHA. Mr. AuCoin.

BALLISTIC MISSILE VERIFICATION

Mr. AUCOIN. Thank you, Mr. Chairman.

Dr. Fields, I want to ask a question about short time of flight verification. At my instigation, the House Defense Appropriations Committee, for the current fiscal year, fenced $2 million in your line for studies of verifying short time of flight ballistic missile tests.

The Senate bill didn't have that kind of restriction and the conference report ended up being silent on the matter, so you had the House side with the fence, the Senate without the fence, and a silent conference report.

Under those circumstances, the House restriction applies, but I understand that there may be some confusion in your shop on this question. My investigation of the law is that it is quite clear on this subject. In circumstances of this kind, the restriction would hold. I have discussed this with committee staff. I believe the committee staff will vouch for this.

Mr. Kilian, am I correct in that interpretation of the law?

Mr. KILIAN. There is a statement of the managers in the conference report to that effect.

Mr. AUCOIN. Under those circumstances, Dr. Fields, and I know you want to be responsive to the Congress, you always have, I want to work together with you, but I do want to get that confusion cleared up. I hope this information for the record today will help clear up the confusion. Could you get back to me by the end of April since I was the one who initiated the House language—say by the end of April—with your preliminary ideas on what research you are going to commission.

Dr. **Fields**. We will do that.

[The information follows:]

> We have discussed a plan for resolving the issues related to short time of flight ballistic missiles with Rand Corproation. They have agreed to conduct a study for DARPA to identify the cognizant issues, evaluate the requirements for test monitoring and evaluate the impact of new technological developments. Also the impact of potential test ban language on present and planned U.S. development activities will be evaluated. A proposal to conduct this study effort is currently being evaluated. The proposed cost for its initial study is $200,000 and will take six to eight months.

SATELLITE SURVIVABILITY

Mr. **AuCoin**. Let me ask you a question on satellite survivability. Envision for a moment if you would a race that is unconstrained between ASAT technology and satellite survivability technology. I asked your predecessor to envision such a race and I asked him which would most likely win, ASAT technology or satellite survivability technology, and he said that ASAT technology would win in an uncontested race. Yor are nodding your head. My question was going to be do you agree or disagree with your predecessor? You are nodding your head. Does that mean that you agree with him?

Dr. **Fields**. No actually it doesn't. I was nodding my head because I recall the incident quite clearly and recall——

Mr. **AuCoin**. Do you agree or disagree with it?

Dr. **Fields**. I would rather not comment because there are very classified issues here and commenting one way or the other would reveal too much. He was not aware of a number of things.

Mr. **AuCoin**. Mr. Chairman, I can understand and appreciate that. I just posed a question to Dr. Fields that is an important one that deals with what happens if the two sides get involved with an unconstrained race between modernized ASAT technology and satellite survivability technology and if you run both of those races, which one wins.

He indicated we are not at a level of classification at which he can answer the question. I can respect that. I do think this is a good time to ask you, Mr. Chairman, if you would consider—I have mentioned it before—consider a special hearing with the CIA and DIA and any others—on the question of ASATs and satellite survivability. There is a briefing to be made here. I really do think that given the heat of the issue, it is one that the committee ought to hear and maybe this question could be addressed in the same hearing. I would like to renew that request, Mr. Chairman. Thank you.

Mr. **Murtha**. Any other questions? Mr. Livingston.

Mr. **Livingston**. No. I think Mr. AuCoin is right, Mr. Chairman. I think we probably ought to have that hearing, Mr. Chairman.

Mr. **Murtha**. We will set up a classified hearing at a later date.

Thank you very much, Dr. Fields. We appreciate the work you are doing. I am going to recommend that to Secretary Cheney, I have been trying to get people to streamline in the Pentagon like you have done for a number of years without much success.

Mr. Dicks has some questions for the record, and we will have some additional questions for the record.

The committee will adjourn until 1:30 p.m. this afternoon.

[CLERK'S NOTE.—Questions submitted by Mr. Dicks and the answers thereto follow:]

DUAL USE TECHNOLOGIES

Question. Dr. Fields you open your statement with a listing of some of the contradictory advise you are receiving. In particular, you note that you are advised that in light of the state of the nation's economy you should concentrate on a dual-use technology in order to shore up the U.S. industrial base, thus contributing to national security through enhanced economic strength.

On the other hand you are also advised by others, that investment in dual-use technology is best left to the private sector and that you should concentrate your investment on military unique technology that would not otherwise be available to the services.

What is your professional judgment on this issue? What is an appropriate role for DARPA and is there some middle ground between these points of view that may be appropriate?

Answer. DARPA's primary role is to foster high-risk, high payoff technology development for military applications. While DARPA's work in dual-use technologies has a historical basis, DARPA has never actively sought a role in the development of technology for civilian purposes, since DARPA's charter specifies a military application requirement. Although many of our products have had commercial implications, these results have been by-products of efforts aimed at improvement of military systems and functions. DARPA's dual-use technology successes are well documented—but in every case, commercial success has been an incidental advantage rather than primary goal. While DARPA's existing programs in low-cost graphics processors, next-generation personal computers, flat panel display, software technology, and networking, including fiber optics, have potential for eventual commercial applications, the pursuit of strictly civilian efforts is outside DARPA's purview.

Question. One tool for promoting dual-use technologies is through consortia, such as we have in place with SEMATECH. Is this an area that might be expanded to promote development of dual-use technologies with a blend of government and private investment?

Answer. Consortia, such as the SEMATECH consortium, where private companies and government share resources and work together towards a common goal are an excellent method of assuring the transfer of technology of all kinds. It should be noted that in appropriate circumstances, consortia and similar partnerships work not just for dual-use technologies, but equally well to reduce the cost of defense R&D efforts of all kinds.

Question. Senator Glenn has introduced legislation that would convert the Department of Commerce into the Department of Industry and Technology. At the heart of the legislation is an Advanced Civilian Technology Agency modeled after DARPA. This approach has also been endorsed by the Office of Technology Assessment. In your judgment would this be a better approach to the dual use issue than focusing solely on DARPA?

Answer. Since DARPA cannot satisfy technology development requirements that do not have military implications, a civilian version would certainly be a better approach than relying on DARPA to meet these needs.

Question. What is your current relationship with the rechristened National Bureau of Standards? How would you assess the performance of this new agency to date?

Answer. Our relationship with the National Institute for Science and Technology (the correct title of the rechristened National Bureau of Standards), is excellent; they have done some outstanding work to date.

Question. My discussions with the industry indicate that while DoD gets criticized for its management, it is far more capable and experienced in managing major R&D efforts than civilian agencies. For this reason they would prefer that DoD perform the mission, or at least provide some transition assistance. Is this a factor that you have looked at and if so what are your thoughts on it?

Answer. I have not done a comparison of this sort, and really cannot speak to an assessment of civilian agency R&D efforts.

[CLERK'S NOTE.—End of questions submitted by Mr. Dicks. Questions submitted for the record and answers thereto follow:]

ADVANCED SUBMARINE TECHNOLOGY PROGRAM

Question. Three years ago, Congress started DARPA's advanced submarine technology research program due to dissatisfaction over the Navy's commitment to "leap-ahead" technologies. Over $300 million has been appropriated to date. Dr. Fields, please describe the general areas of research being addressed in this program.

Answer. The Advanced Submarine Technology Program (ASTP) is charged with developing advanced submarine technology concepts leading to revolutionary improvements in submarine operational capabilities. The program develops technologies in the areas of Hydrodynamics and Ship Control, Materials, Structural Acoustics, Mechanical and Electrical Systems, and Platform Support Systems.

Question. After three years of effort, what is DARPA "bringing to the table" that would not be there if the Congress had invested the $300 million in Navy research programs?

Answer. DARPA brings a unique approach and capability to the development of technology, with long established ties to R&D industries, "think tanks," and academic institutions. The ability to pursue high risk technologies with potential high payoffs is a DARPA characteristic. Because of these unique circumstances, the following significant examples have or soon will emerge from the ASTP.

Acoustic radiated noise and target strength reduction technologies offering revolutionary submarine quieting capability.

Establishment of a Submarine Hydrodynamic/Hydroacoustic Technology Center offering dramatic improvements in computational methods of predicting submarine response.

Non-penetrating periscope equipped with electro-optic sensors. Such a design improves submarine survivability by removing a major pressure hull penetration, reduces non-acoustic detectability, and allows design alternatives in the location of the submarine's sail.

Metal Oxide Semiconductor (MOS) controlled thyristors offering significant improvements over conventional electrical distribution devices in terms of size, weight, and cost.

Suprelite composite submarine propulsor offering reduced weight and improved performance features. Fuel cell technology that could provide an improved source of emergency power with greater capacity and the ability to operate in all environments, including under ice.

An electromagnetic countermeasure launcher that is markedly quieter than the current launcher, eliminating a significant submarine transient noise.

Question. Do you consider the DARPA program to be a success? If so, why did DoD not budget any fiscal year 1991 funds to continue the program? How much is needed?

Answer. Yes. The administration, after evaluating and prioritizing competing requirements, could not justify funding the Advanced Submarine Technology Program.

Question. Understanding that much can change in the future, describe the Defense Department's current thinking about funding this type of work in the outyears.

Answer. In a time of decreasing budgets, investment in research and development remains a critical necessity. DARPA intends to request funding for ASTP in fiscal year 1992 and expects to receive strong support in the department.

Question. A recent GAO report generally praises the DARPA program, but states "the Navy has not developed a strategy for effectively transitioning advanced submarine technology research. Further, the Navy is not considering ASTP research in designing the SEAWOLF submarine and is not planning the submarine design with features that will facilitate later implementation of technologies." What is the problem here?

Answer. DARPA has worked closely with the Navy to facilitate the transition of ASTP research into real Navy programs. The Navy has submitted to the Congress a detailed transfer plan for the SubTech program results and DARPA has submitted to the Congress an annual report on the SubTech program. The reports are consistent and detail dates of transfer of program components. Technologies developed in the SubTech program can be applied to upgrade the 688 class and Trident class submarines; can influence the detailed design, development and construction of the Seawolf; and can be a fundamentally new foundation for a future generation of truly stealthy submarines. As I mentioned in my prepared statement, the most impactful advances are so fundamental that they are really aimed at future submarines.

NON-ACOUSTIC ASW RESEARCH

Question. The Congress has a long-standing frustration with the Defense Department in the area of non-acoustic ASW research. In the last four years funds have been appropriated to first the Navy, then the CIA, then DARPA, and now to OSD. Our concern has been to develop a truly national approach to this problem. Understanding that some aspects of this problem are classified, would you please comment on the nature of this problem and your advice on how the Congress should approach it.

Answer. Finding quiet submarines is an extraordinarily difficult problem. The signatures of submarines are very weak; the ocean is cluttered with a wide variety of strong signatures; and, propagation of signals is not adequately well understood, with respect to both theory and ocean data. The program management organizations that should be responsible for development and testing of non-acoustic ASW technology are DARPA and the Navy, with DARPA in its chartered role of supporting high risk, high impact "revolutionary" approaches. The DDR&E should be responsible for assuring coordination and cooperation between the Navy and DARPA, although I must note that we are now working very closely with the Navy. The Navy and DARPA have joint development plans which should be presented to the Congress at the proper classification level in a few months. I am confident the Congress will be pleased with the approach we have taken when all parts of the story are told together.

Question. In the add-on funding that Congress provided to DARPA in fiscal year 1989, how were these funds used and what were the results?

Answer. The guidance for expenditure of the $15 million add-on was that $10 million was to be spent on advanced torpedo research, and $5 million was to be spent exploring new vistas in ASW. The funds were expended in that manner, although there were some small changes in the amounts driven by technical needs. We developed some fundamentally new concepts in submarine prosecution that go far beyond conventional torpedo research. And we gave a contract to Lawrence Livermore National Laboratory to examine new aproaches to ASW, with results incorporated into DARPA's ASW program. Incidently, that contract was awarded strictly on merit, not because of the name "National Laboratory."

Question. What is your view of the feasibility and desirability of having the Department of Energy's national labs (e.g. Sandia and Los Alamos) participating in the DoD program?

Answer. I strongly support the position that awards should be made based on technical merit. We have chosen to support Los Alamos, Sandia, Lawrence Livermore, Argonne and other National Laboratories based on technical excellence and we will continue to do so.

Question. What is your view of the direction that DoD as a whole is heading? Are we making progress, or is the problem getting worse?

Answer. I am satisfied that a good plan is in place for non-acoustic ASW R&D and that we are making progress. DARPA is working very closely with the Navy and the whole story of non-acoustic ASW R&D needs to be heard, but this can only be done in a special access/classified forum.

HIGH DEFINITION TELEVISION (HDTV)

Question. The Congress last year increased DARPA's role in the development of HDTV technology for military applications. Dr. Fields, please describe HDTV technology and what it offers for military applications.

Answer. First of all, almost everyone improperly uses the term HDTV—it is not just a consumer entertainment television. What is really meant is a varied collection of low unit cost, high production volume and high performance, low profit margin items for consumers, business, and the Government, including the Military, such as advanced televisions, VCRs, camcorders, FAX machines, laser printers, personal computers and much more.

What ties all these products together is that, driven by advances in digital technology, all will be built from about the same technology components—memory and processor chips, solid state displays, digital data storage devices, and so on.

Further, high unit cost, low production volume and high performance, high profit margin items also use about the same components, e.g., supercomputers, command and control systems, and so on.

So when people use the term HDTV they really mean the entire electronics infrastructure of the United States.

Viewed in this light, and considering that DoD is more and more using commercial components rather than MilSpec components, the military applications of the components—memory and processor chips, solid state displays like flat panel displays, digital data storage devices—are all-pervasive in DoD sysems. And assembled display systems are in command centers, fighter planes, submarines, intelligence centers and everywhere else.

Question. On what areas of this technology is DARPA focusing?

Answer. DARPA is developing flat panel displays, solid state projection displays, image processing chips, architectures and algorithms. All are being done consistent with emerging commercial specifications, but we are not building any consumer entertainment products.

Question. Last year the Appropriations Conference Committee restricted obligation of funds that were added to DARPA's budget (beyond those originally requested) for HDTV research until the Executive Branch submits a plan for a government-wide HDTV program. What actions have you taken to try to accommodate the Congressional reporting requirement, and how successful has this been?

What actions would you suggest that we take to try to resolve this apparent impasse?

Answer. We asked OSTP and the President's Science and Technology Advisor to respond, since I received guidance from the Congressional staff that the term "Executive Branch" meant the White House. And, subsequently, we asked the Department of Commerce to respond because the Secretary of Commerce announced to the Congress about a year ago that the President personally asked him to take the lead within the Government on HDTV. To date I have seen no report for the Congress. In fairness to those organizations, they have been highly supportive of DARPA and have maintained very good relations with my Agency which I want to continue in an atmosphere of good will and cooperation. I believe they are fully supportive of our work in high definition display components and fully aware of the significance of HDTV.

Meanwhile over 40 "technically winning" proposals, many from small businesses with limited resources, are going unfunded, particularly those for manufacturing technology for the display components on which DARPA has begun R&D.

My only suggestion for resolving this apparent impasse would be for the Congress to accept that DARPA has been diligent in trying to meet the requirements of the legislation, that continuing to impose those requirements is harmful, and that we should be allowed to obligate those funds for technology specifically consistent with our national security mission within the Department of Defense.

Question. We understand that everyone is under tight budget constraints. However, do you feel that DARPA's HDTV program is fully funded to achieve optimal results?

How much is budgeted in FY 1991 for DARPA HDTV?

How much is required?

What are your current plans for "outyear" funding?

What is required for "outyear" funding?

Answer. We have requested $21 million for high definition display components in our FY 1991 budget submission. We expect to request a final $3 million in FY 1992. As you may appreciate, I cannot comment on further resource requirements.

COMPUTERS AND SOFTWARE

Question. Perhaps nothing is more important to our nation's international competitive posture or to our ability to maintain an advanced technology lead in weapons over our potential adversaries than advanced computer processing capability. We see in many weapon system acquisition programs that this is also a very troubled area. In FY 1991, DARPA is requesting: $109 million for strategic computing; $34 million for intelligent systems; $19 million for the Software Engineering Institute; and $15 million for STARS (Software Technology for Adaptable Reliable Software). Dr. Fields, what is DARPA trying to accomplish with all these computer and software programs?

Answer. We are accomplishing the following:

Building the world's fastest high performance computers, and those most compact, most cost-effective and most energy efficient—as required for real time ASW, image and signals analysis, cryptanalysis, and many other DoD requirements—but built to commercial specs as dual use technologies with many spin-off applications;

Building the world's highest performance and most survivable digital telecommunications network for command and control and other weapons applications—but built to commercial specs as dual use technologies with many spin-off applications;

Developing the world's most advanced artificial intelligence capabilities, most recently capabilities for systems that learn and automatically improve their own performance, with application to smart weapons, battle management and many other DoD needs—

but developed to commercial specs as dual use technologies with many spin-off applications;

Developing the world's most advanced software production technology to reduce software cost, improve software reliability and control vulnerability to computer viruses and other security attacks; developing "industrial strength" software tools for U.S. industry in our Software Technology for Adaptable and Reliable Systems (STARS) program; and transitioning those software tools and best software practice to U.S. industry through out Software Engineering Institute (SEI).

Question. The Committee has been interested in getting "how to" software information into the hands of DoD weapon system acquisition managers, rather than technical academic computer jargon. How do DARPA programs contribute to this objective?

Answer. That is exactly the purpose of the SEI and they are doing an excellent job.

Question. Primarily due to our disgust with the computer mess at Cheyenne Mountain, the Committee added funds for the DoD's Software Engineering Institute to get them more involved with helping weapon system acquisition managers to solve their software problems early. DoD thought so highly of this they proposed the funds for deferral. Do you know why?

Do you agree with the line of thinking that expanding the SEI would serve no useful purpose?

Answer. I don't know why. The SEI could be usefully expanded, and I assume this is a matter of priorities decided above my level within the Department.

SEMICONDUCTOR AND INTEGRATED CIRCUITS

Question. Advances in semiconductor technology are vital to the nation's international competitive posture, as well as for advanced Defense computational processing requirements in areas such as radars, ASW, and sophisticated weapon sensors.

[NOTE.—The SEMATECH initiative is aimed at smaller and faster chips, while the X-Ray Lithography initiative is aimed at even better capabilities in the long term. In FY 1991 DARPA is also requesting $86 million for MIMIC (microwave/millimeter monolithic integrated circuits) and $22 million for gallium arsenide applications.]

Dr. Fields, in layman's terms could you explain to the committee why semiconductors are important, what capabilities we possess today, what capabilities we desire in the future, and how DARPA's programs relate to these efforts.

Specifically address what plans you have to move academic research findings into actual production lines to manufacture the chips in sufficient quantities with acceptable quality.

Answer. The term "semiconductors" is colloquially used to refer to the myriad of high performance components from which essentially all modern electronic systems are assembled in building-block fashion—all computers, telecommunications equipment, medical equipment, consumer electronic equipment, avionics systems and so on. If you plug it into the wall, if it has a battery, or if it works off a generator it's probably made with semiconductors. The entire technology base of modern industrial society—and certainly the critical functions of the Military—rests on electronics. Electronics, in turn, is mostly the assembly of semiconductor components, and semiconductor components can only be made with very specialized tools, expensive facilities, and particular high quality materials.

Because of technological advances, semiconductors—and the electronic systems which are assemblies of semiconductors—are rapidly decreasing in cost, size, and power consumption; and increasing in performance: today's personal computer was yesterday's supercomputer.

The organization—country or company, military or civilian—that controls the best semiconductor materials and equipment and which invests in the best semiconductor facilities will have the best semiconductor components; and in turn the best electronic systems. The organization with control of the best electronic systems has an edge in essentially everything that depends on electronics.

For DoD, electronics is the central technology underlying our strategy of countering numerical superiority with technical superiority. It is the basis for our military communications, intelligence systems, space systems, vehicle design including stealth, vehicle control including advanced avionics, smart weapons, precision guidance—everything.

DARPA is developing the designs for the highest performance semiconductor components. We are developing the manufacturing technology not only to make these components at the lowest cost but also in the small volumes needed by DoD. We are developing techniques for the economical production of the highest quality materials, the most precise tools, the fullest integrated set of design tools, semiconductor components, semiconductor packaging and electronic system assembly, and semiconductor-electronic system-software design.

The heart of our management approach is the experimental semiconductor pilot production line which serves as an industry laboratory for developing the technology, and to receive and integrate findings from universities and national laboratories.

Question. We are a number of years into the SEMATECH initiative, for which $100 million is requested in fiscal year 1991. What results are you seeing from this investment?

Answer. SEMATECH is on schedule and within budget in technical development and dissemination of results to their member companies. I would rather report on their particular technical accomplishments in a separate context since so much is proprietary. But the larger question is whether the technical accomplishments of SEMATECH will sustain the U.S. semiconductor industry—will it sustain market share? There the jury is still out. It depends on many factors besides technical accomplishment—capital investment which is in turn dependent on capital cost; relative appetite for profit; access to foreign markets; protection of U.S. intellectual property; enforcement of our anti-dumping and anti-trust statutes, to name a few factors. We have a lot to do.

Question. Congress has been active in providing additional funds each year for X-Ray Lithography. How much is requested in fiscal year 1991? Is this adequate to meet your requirements?

Answer. No funds were requested for this technology in fiscal year 1991.

Question. Explain the need for the other DARPA work in this area.

Answer. I think I have explained the importance of the current DARPA efforts, and as you can understand I cannot comment on shortfalls.

ARMOR AND ANTI-ARMOR PROGRAMS

Question. Due to the 1985 Defense Science Board report on DOD armor and anti-armor deficiencies coupled with the Soviets' fielding of reactive armor on some combat vehicles, DARPA got more involved in advanced research in this critical area. The fiscal year 1991 budget requests about $29 million for this purpose, down from the $37 million appropriated in 1990.

We understand that there has been some controversy between DARPA and the Army over the future direction of this research. What is the nature of the dispute?

Answer. DARPA and the Army agree that the current work is of the highest quality and that tremendous progress has been made but that more work needs to be done. DARPA and the Army agree on the technical directions that should be followed in the next few years.

The issue is funding. DARPA, the Army and the Marines are completing a five-year MOU at the end of FY 1990. DARPA has invested about a quarter of a billion dollars in this effort which is the majority of the investment under the MOU. As you know, DARPA is supposed to start things off, and then transfer the work to the Services for continued R&D, production and deployment. If DARPA doesn't stop things we won't have resources to start new programs, respond to new technology, and address new threats and needs. That is particularly apropos in the armor/anti-armor efforts where a large part of the work is fixed expense for permanent capabilities in testing and intellilgnece analysis—the Red Design Bureau.

We informed our partners that we would be making that handoff with reduced funding of $11 million in our FY 1991 request and an expected request in FY 1992. We did so giving them about two years notice, in May 1989, so that they could make their funding plans.

I don't think the Army or Marines have stepped up to continued funding of the program at anywhere near the current level, but that has to be their decision based on their priorities. In the case of the Army they are enjoying real growth of about 2 percent in technology base while DARPA is experiencing about 6 percent real decline. If the Army considers the armor/anti-armor program less important than the least important funded project within their $6 billion R&D budget I don't feel I am in a position to tell them their priorities are not right.

My view is that this is a situation where the DDR&E should step in and see that the right funding is applied. I have asked him to do so and he has agreed. No one wants this to fall through the cracks.

Question. What do you see at DARPA's future role in armor and anti-armor advanced research?

Answer. We by no means want to leave the problem of the armor threat unaddressed, and in fact we are increasing our investment. We are working on smart weapons, smart mines and counter-mine technology, power sources and materials applicable to armor and anti-armor, battlefield reconnaissance, surveillance and target acquisition, battle planning for armor warfare and a host of other "high tech" projects. Our best program which we are in fact increasing is a "breakout" solution to the vicious cycle of more-armor/better-penetrators, which seems almost endless.

Question. What have been the results of DARPA's armor research program so far? Please explain your important findings and important technologies that you have developed.

How much of this has been incorporated into Army weapon systems?

What are your future technical goals for this effort? Specifically, what technologies or approaches are you forecasting as candidates for future advanced research?

Answer. The Armor Protection Systems Programs conducted by the Armor/Anti Armor Joint Program Office was initiated to develop and test advanced technology armor systems for potential application to light and heavy combat vehicles which would provide significantly improved protection at reduced weight. The technology efforts focused on providing high ballistic performance advanced materials and new defeat mechanisms coupled with novel geometry arrays that would emphasize low cost of production, near net shape processing, new compounds, and innovative attachment techniques. The program is a two-phase program with Phase I concentrating on near term threats and Phase II armors capable of defeating future kinetic energy and chemical energy threats through the 2005 time frame.

Phase I culminated in a competitive evaluation of industry-developed responsive and reactive armor designs against the U.S. Army-developed baseline for designated areas in the M1A1 Block II Survivability Enhancement (SE) Program. There were multiple designs submitted by industy that bested the Army designs in two of the three areas evaluated (there were no passing designs, Government or industry, in the third area).

Successful concepts will be transitioned to Army if the Block II SE Program is pursued. Program success was also achieved in light armor application with the feasibility demonstration of the Light Applique System Technique (LAST) program. LAST provides a quick non-destructive attachment mechanism that can provide a rapid protection upgrade for a variety of vehicle applications. This program should be of significant interest to the Army, USAF, USMC, Navy, DOE, FAA, Coast Guard, Special Operations community and others that require a lightweight, cost effective attachment scheme to provide additional protection for their systems or personnel.

Significant results of this research program to date include:

1. The establishment of a viable U.S. industrial capability for the development of armor.

2. The demonstration of armor technologies which have the potential to significantly enhance the ballistic protection of U.S. fighting vehicles.

3. The development of high pay-off armor manufacturing technologies which have the potential to provide affordable solutions for near term and future armor applications.

4. The establishment of technical and administrative mechanism to permit the transition of promising technology which has been evaluated for integration in accordance with the Abrams Main Battle Tank. Additional efforts are underway to transfer technology of interest to the Army's Bradley Fighting Vehicle and USMC's Light Armored Vehicle (LAV) and Advanced Assault Amphibious Vehicle Programs.

Question. What are your future technical goals for this effort? Specifically, what technologies or approaches are you forecasting as candidates for further advanced research?

Answer. Future goals included in Phase II are to provide a catch-up, leap ahead and stay ahead industrial capability in advanced armor technology. The three selected team leaders (DuPont, General Dynamics Land Systems, and Honeywell) are pursuing high risk-high payoff defeat mechanisms utilizing advanced technology armor materials in the development, testing, and fabrication of engineered armored sections for ultra-light, light, medium and heavy vehicles. Priority in the program is in the development of modular armor sections for potential inclusion in the Army's Block III tank. Technology efforts include development of new insensitive energetic materials, materials with customized properties, new compounds, fracture tough ceramics with controlled grain size, cermets, and new polymers that function across a broad temperature range. Low production cost will be emphasized during technology development as well as Service capability to integrate the technology into future vehicles. The program will continue development and improvement in the hydrocodes and analytic codes by both industry and our national laboratories in an attempt to advance the state of the art in computer-driven design optimization.

LOW INTENSITY CONFLICT

Question. The General Accounting Office issued a report last week entitled "The Low Intensity Threat is Not Necessarily a Low Technology Threat." Low intensity threat includes a large number of countries where domestic instability, terrorism, insurgencies, regional war, narcotics trafficking, or other problems are likely to occur. GAO found "little, if any, guidance to help U.S. armed forces determine what specific weapons U.S. forces are most likely to meet and therefore, what specific technical challenges U.S. defense hardware should address." Of course, this a broader issue involving more than DARPA, but DARPA will be on the leading edge of finding the best solution to this problem. Dr. Fields, do you agree with GAO that the low intensity threat is not a low technology threat?

Answer. Third World countries are buying or developing weapons so lethal and effective that the term "low intensity conflict" is no longer instructive. Third World countries have tanks, ballistic missiles, submarines, chemical and biological weapons, and much more.

Question. What is DARPA doing to meet this challenge?

Discuss the specific research projects currently underway aimed at fielding advanced weapons to meet the low intensity threat.

Answer. Since there is no real boundary anymore between low intensity conflict, more properly called regional conflict, and "regular" theater warfare we don't have a separate program in DARPA addressing such conflict—most of our projects apply. I am including here all our intelligence related efforts particularly important for regional conflicts, our work in precision strike weapons, survivable unmanned aircraft and much more. There are some special cases, like in batteries or covert communications, where we have special projects particularly attuned to regional conflicts. DARPA is a natural focus for such efforts which are inherently tri-Service, frequently require rapid response, and don't fit into the conventional structure.

Question. Do you agree with GAO's assessment that there is confusion about what is needed and how to proceed?

Answer. We aren't confused. A few years ago I did a report for the DCI laying out a comprehensive progam in this area, and DARPA has been executing that program as an integral part of our strategy since regional conflicts are playing a larger proportional role in our responsibilities.

Question. What assumptions are behind DARPA's technology programs for the low intensity conflict threat?

Answer. Our assumptions are: a) there is no clean boundary between regional conflicts and larger scale conventional conflict; b) we can't afford a complete separate inventory for conventional uses and regional conflicts so we need double-duty technology and systems; c) there is shared technology among that for regional conflicts, counter-narcotics and counter-terrorism; d) in a few cases we need special equipment. We are willing to give to Third World allies, equipment that is small, light, rugged, inexpensive, easy to use, and will not compromise sensitive technology if it falls into the wrong hands.

Question. Please describe DARPA involvement in the recent Persian Gulf operations. How did DARPA contribute?

Answer. DARPA was able to rapidly respond in a matter of 8 or 9 months to develop mine hunting equipment using laser techniques and, separately, unmanned underwater vehicle/sonor technology and get it into user hands. This is an example of lower risk and low cost work for the Agency, but with great potential impact because of rapid response.

TREATY MONITORING

Question. DARPA has a major role in international weapons treaties, both as they are being written and after they are signed. DARPA is requesting $37 million for treaty verification in FY 1991. Please discuss DARPA's advisory role to U.S. negotiators of international treaties.

Answer. DARPA volunteered to provide a full time "chief scientist" to support our Ambassador in Vienna at the CFE talks, and he is there now. We wanted to assure that positions taken by the U.S. team were technically sound, that treaty provisions could be technically verified at an affordable cost, and that our best systems were not inadvertently put at risk. I am making a special effort to link the technical activities in DARPA with the Policy side of DoD. For years we have been doing a similar service at the nuclear test ban talks and we could do so with other treaties.

Question. Describe DARPA's philosophy for "dual-use" technologies that provide wartime capabilities but also peacetime treaty monitoring utility.

Answer. DoD can't afford to have totally separate inventories of systems for wartime intelligence, peacetime national security intelligence functions and treaty monitoring. We need to have multiple use systems. There is no reason why DARPA's systems for finding, identifying and counting wartime targets cannot, with small change, also serve for treaty monitoring, and that is what we are trying to do in all of our programs. For example, our ultrasensitive ——— chemical or biological weapons should also be useful for a treaty monitoring function.

Question. Take a moment to describe DARPA technology programs and the technology challenges involved for: INF treaty compliance, Chemical weapons treaty compliance, and START/nuclear weapons treaty compliance.

Answer. Our ongoing targeting programs will provide a foundation for monitoring INF and START, and with respect to the latter we have developed a remarkable imaging gamma and neutron detector for finding and identifying nuclear warheads. We have ultrasensitive chemical and biological warfare agent detectors. Besides increased sensitivity—by a factor of about a billion—the detectors can respond to toxic agents even if we don't know the chemical or biological character of the suspect agents by mimicking the response of the targeted biological systems, a way to get around attempts at treaty violation through inventing new weapons.

Question. How will the fiscal year 1991 funds be used?

Answer. Most of the funds will be spent on nuclear test ban treaty monitoring, but we are branching out into CBW verification as indicated. Further, this year we are doing a project on laser ASAT verification and if that proves fruitful we will continue the effort.

Question. Do you have unfunded requirements in this area?

Answer. I can't comment on unfunded requirements.

Question. Explain how DARPA's work differs from that done by the Services in treaty compliance monitoring.

Answer. As usual, we are taking prudent technical risks to push out the envelope of performance to "world record" levels; and we are pursuing our multi-use philosophy to reduce costs.

STRATEGIC RELOCATABLE TARGETS

Question. The Defense Department has a master plan for developing technology to enhance attack of relocatable targets. While there are many targets in this category, of primary concern is Soviet mobile ICBMs (SS–24 and SS–25). The Congress has been concerned about the fragmented approach to solving this problem rather than a coordinated effort. Dr. Fields, describe the problems inherent in locating and attacking relocatable targets.

Answer. Soviet mobile missiles seek to achieve survivability through their capability to move over large areas of Soviet territory on a prompt and frequent basis. Further, they make extensive use of their ability to blend into the background; i.e., the road-mobile SS–25 makes use of the natural concealment of dense forested areas and the rail-mobile SS–24 uses the same rail lines as other Soviet rolling stock. In order to locate and attack these targets, U.S. forces must be able to employ sensors to relocate the mobile missiles within their movement timelines.

Question. What kinds of technology are required to be developed in order to accomplish this objective?

Answer. While many technologies must work together within the context of a total weapon system, the critical technologies required to achieve the objective of locating and attacking relocatable targets are sensor and processing technologies. The sensors must be able to detect and identify unique signatures which differentiate the mobile missiles from their backgrounds. Automatic target recognition technologies are required to process large amounts of sensor data on a near-real time basis in order to search the relatively large potential deployment areas. Operating together, the sensors and associated processing must achieve a fairly high probability of detection and an extremely low false alarm rate.

Question. What is DARPA doing?

Answer. For the last three years, the DARPA Relocatable Target Detection Technology Program has concentrated on understanding the fundamental technical issues associated with the detection and recognition of targets in hiding which employ deception and denial techniques. A major focus of the program has been directed toward the development of techniques to reduce the false alarm rate during the initial detection (i.e., broad area search) of these difficult targets. To date the program has been able to demonstrate a three order of magnitude decrease in false alarm rate over existing techniques with acceptable probabilities of detection. Current efforts are attempting to confirm these results over a wide variety of seasonal and deployment conditions. Additionally, new techniques are being evaluated to further reduce the false alarm rate with modest increases in probabilities of detection. Other parts of the Relocatable Target Program have concentrated on development and evaluation of techniques directed toward the classification of these targets after initial detection. A major part of that effort is directed toward the evaluation of previously unexploited observables. Additional effort has involved the fusion of pixel registered multi-sensor data to further reduce false alarm rates at classification level. The current program has placed a special emphasis on understanding potential counter-measures which could be employed against these sensors and developing the appropriate counter technologies.

Question. What are the Services doing?

Answer. The Air Force's program element 63367F, Relocatable Target Capability Program, is devoted to enhancing near term capability against mobile ICBMs. This effort and the DARPA Relocatable Target Program are closely coordinated. The DARPA Relocatable Target Program Manager chairs the DoD Relocatable Target Technology Panel.

Question. What is the intelligence community doing?

Answer. While DARPA is generally familiar with many of the efforts the intelligence community is applying against the relocatable target program, the details of these efforts should be provided directly by the intelligence community.

Question. Who is in charge of the coordinated effort?

Answer. A DoD-Intelligence Community (IC) Memorandum of Understanding establishes parallel organizations to review and integrate strategies, programs, research and studies of the relocatable target problem. These policy making panels are made up of senior level people within DoD and IC to coordinate activities of the respective organizations. The DARPA Deputy Director, Dr. Vic Reis, participates with the DoD steering panel.

Question. How many billions of dollars do you think would have to be invested by DoD to effectively solve this problem?

Answer. It depends on what you mean by "solve this problem." We can have the technology base for a very high level of SRT detection—say 90 percent—and very low false alarm rates—say <0.01/sq km for less than a billion dollars. The cost of deployment is another issue. But that will leave 10 percent of SRTs undetected and that can be enough to destroy an entire country. You see here the difference between the tactical and strategic problems. In the tactical arena if you find and negate 90 percent of the enemy's assets you are a hero; in the strategic world if 10 percent of the enemy's assets are effective you have a very, very serious problem.

Question. How many years away are we from a valid technical solution?

Answer. At the 90 percent level I can see a technical solution in ———.

Question. What have been DARPA's accomplishments in this area so far?

Answer. DARPA has been able to quantify the false alarm rates for the wide area search of road mobile ICBM's under a number of realistic deployment conditions with promising sensors. Both synthetic aperture radar and active/passive infrared sensors have been developed and tested. Automatic processing techniques have been developed which have been able to significantly reduce false alarm rates while maintaining a high probability of detection.

ANTI-SATELLITE PROGRAM

Question. Late last year, OSD selected the Army to be the DOD executive agent for the kinetic (missile) ASAT development program after considering alternate approaches from the services and DARPA. Kinetic ASAT provides a near-term, low earth orbit ASAT capability. Next year, OSD will select an executive service to develop the longer term directed energy ASAT development program after considering the Services candidate approaches. Dr. Fields, please describe DARPA's approach for the kinetic ASAT.

Answer. The current approaches to Kinetic ASAT employ a "hit" vehicle which passively detects and seeks the target by means of its IR radiation or its reflection of visible light from the sun. The IR radiation from a satellite is low and this demands a highly complex seeker and limits detection range; use of a visible seeker demands that the booster is large enough that it can guarantee a sunlit intercept. DARPA's approach to kinetic ASAT, called ASCOT, was based on the use of a ground-based laser illuminator to make the target bright (in the wavelength of illumination) at all times of the day. The seekers, then, can be cheap, light, and simple. This is the same concept as was used during the Viet Nam War with laser-guided munitions so there's nothing really new here. The innovation is that the same principle can be used in space.

Question. What advantages did you feel DARPA's approach offered compared to those advocated by the Army, Navy, and Air Force?

Answer. The biggest problem with passive seekers is, of course, complexity; ASCOT shifts the complexity to the ground (illuminator) where we felt it could be handled easier. But a second big payoff is ASCOT's ability to defeat countermeasures. Since only the target is illuminated from the ground and at a wavelength known only to the ASCOT system, deception by spurious sources or decoys is virtually impossible. Further, since the target can be tracked by the interceptor from very far away, it can easily compensate for target maneuver.

Question. What is the reason you were given by OSD for why the DARPA approach was not adopted?

Answer. The ASCOT concept was not presented to OSD by the designated agent, the Joint Program Office, on the basis of its analysis that ASCOT could not meet the sanctioned JCS requirements. This requirement called for a certain set of targets to be engaged and a certain rate of target kill. Because of certain basing restrictions imposed by the JPO, the particular ASCOT system used in the analysis did not meet the requirement; neither did the Army system ultimately approved by OSD. Further, since the JCS requirement does not call for any capability to overcome countermeasures, the feature of ASCOT did not figure into the evaluation.

Question. If the DARPA approach had been adopted for a kinetic energy ASAT, would a follow-on directed energy ASAT capability still be necessary?

Answer. The ASCOT concept is, in the end, a kinetic kill concept; the target is destroyed by breaking it into many pieces. The debris which results from a kinetic intercept is a major concern which motivates the ground-based approach since no debris is created, only an inoperative target. To the extent debris is a real concern, then, ASCOT does not preclude directed energy ASAT.

Question. Provide for the record the technical capabilities afforded by the DARPA kinetic ASAT approach compared to the alternatives offered by each of the Services, including the percentage of threat targets that potentially could be attacked by such a weapon.

Answer. This will require a tome not producible in sufficient time to be of value.

HYPERSONIC WEAPONS TECHNOLOGY

Question. DARPA's hypersonic weapons technology program was created at the initiative of this Committee a few years ago. The program consolidated ongoing Navy and Air Force programs, thereby eliminating duplication and reducing unnecessary overhead costs. Although initially supporting it, we understand that DARPA has recently scaled back this program. Dr. Fields, what are "hypersonic weapons" and how could they be used?

Answer. The term "hypersonic weapons" describes a family of weapons, or weapons concepts for which the average velocity (ground track) from launch to target is in excess of Mach 5. They can be used to attack targets with extreme precision and where the rapid response capability is important. Such targets include: strategic fixed and/or mobile targets, slowly moving targets (ships) or manned aircraft. They can also be used in a surgical strike role where collateral damage limitation is important.

Question. How much is currently budgeted in fiscal years 1990 and 1991 for hypersonic weapons research, and how does this compare to the estimates for these fiscal years one year ago?

Answer. The DARPA budget for the HWT program is: FY 1990, $8.5 million; and FY 1991, $13.9 million.

How does this compare with the cost estimates of last year? In FY 1989, the proposed HWT budget for FY 1990 and FY 1991 was: FY 1990, $24.5 million; and FY 1991, $15 million.

Question. What is the impact of these reductions?

Answer. The major impact has been to focus the program on captive flight testing of the AXIS system on a supersonic aircraft.

Question. If DARPA abandons this program, doesn't that just motivate the services to pursue their own unique approaches?

Answer. DARPA shouldn't normally be tasked with the responsibility to coordinate apparently overlapping and duplicative Service programs. That is the job of the OSD staff, particularly the DDR&E. Our job is developing and transitioning the highest performance, lowest cost, most impactful military dual-use technology.

Question. We hear that the Department of Energy is initiating development of a Hypersonic Glide Weapon. Please describe that initiative.

Has that resulted in changes to DARPA's program in funding, staffing, philosophy, or otherwise?

Answer. The only DOE activity in the field of hypersonic glide weapons is the SWERVE. This vehicle was developed and demonstrated in the early 1980's. The last test flight of SWERVE was in April, 1985. SWERVE remains an experimental testbed for hypersonic vehicle research and remains the candidate test vehicle for an HWT flight test program.

Question. Are you aware of any Navy-funded or Air Force-funded activities in HWT technology development?

Answer. There are no other directly funded activities, to our knowledge, specifically for HWT by either Service. There are however, other related activities that are funded. For example:

Air Force: A PRDA from AF/BMO for conceptual design of a high performance MARV testbed with emphasis on airframe technologies applicable to a high G vehicle. (FY 91 effort)

Navy: Other block funded programs for technology development for other purposes which may directly or indirectly, have application to HWT.

Question. Provide for the record the funding in each fiscal year 1989 through 1991 in any DoD appropriation for HWT research.

Answer.

Fiscal year:	*Million*
1989	$21.3
1990	8.5
1991	13.9

STRATEGIC DEFENSE INITIATIVE

Question. DARPA has a philosophy of developing technologies and their countermeasures simultaneously, an approach which strengthens both technologies. This approach allows the U.S. to field more effective offensive systems while also fielding capable countermeasures in case threat systems make parallel advances. Dr. Fields, please describe DARPA's measure/countermeasure development strategy for your technology development programs in general.

Answer. With DARPA I encourage the technical staff to manage their programs with the utmost enthusiasm—and concurrently devote their energy to finding ways to obsolete their programs. One way to obsolete their programs is technological advance—obsolete with a faster supercomputer, a stronger material, a more accurate missile, stronger armor and so on. Another way to obsolete is by a countermeasure to a military capability—stealthy submarines and ASW capabilities to find stealthy submarines, smart mines and countermine technology, battlefield lasers and laser protection, and so on. That kind of internal competition requires the highest intellectual integrity but it is absolutely essential.

Question. Do you consider this to be an effective strategy, and if so, provide examples of how this has worked for you.

Answer. This is extremely effective, and I have given you a few examples.

Question. What is DARPA's current role in SDI development?

Answer. We have no joint programs with SDI, but we view SDI as a customer for our advanced technology.

Question. The two critical issues in SDI are cost (specifically, cost effectiveness at the margin) and survivability (specifically, countermeasures). We understand that SDI does its examination of these issues "in-house."

What is your assessment on SDI's methodology for objectively critiquing these critical issues?

In your judgment, would an organization independent of SDI be able to provide more objective assessments? Would such an arrangement better serve both SDI and the Congress?

Does DARPA have technical capability in this regard?

Would you be in favor of DARPA involvement in SDI in this matter if directed by Congress?

Answer. SDI cost and survivability issues receive a thorough examination during the acquisition process within the Office of the Secretary of Defense (OSD). The Secretary of Defense has numerous technical resources DARPA being just one of these, at his disposal to ensure that the best possible Defense decisions are made.

DIRECTED ENERGY WEAPONS

Question. The Services and SDI are all individually working on high power microwave (HPM), lasers, or other directed energy weapon concepts. What work is DARPA doing in this field, and why?

Answer. DARPA is investing in directed energy technologies but our investments are chosen for minimal overlap with the Services and SDIO. Our work in lasers emphasizes a particular laser type, the diode pumped solid state laser, which will find us in the tactical battlefield predominantly as sensors. Our work in microwaves is mainly with the objective of disrupting enemy electronic systems by virtue of particular waveforms rather than with high power. The work in charged particle beams is aimed at the application of tactical, point defense. Each of the first two applications and the technologies that enable them is unique in scope and content in that DARPA is emphasizing low and medium power where the Services are developing high power. DARPA is currently the lead organization in the particle beam work.

Question. Explain how DARPA's program differs from those of the other Services. Specifically, what applications are envisioned?

Answer. As previously stated, DARPA is emphasizing low and medium power, where the Services are developing high power.

Question. How much is requested for fiscal year 1991, and how will these funds be used?

Answer. The total amount for Directed Energy Weapons for fiscal year 1991 is $48.266 million. The breakdown from the congressional submission is:

Title:	*Fiscal year 1991 (millions)*
ST-12—Adv Quantum Electro-Optic	$19.165
TT-06—Tactical Directed Energy Tech	14.601
PB-01—Particle Beam Tech	14.500
Total	48.266

Question. How is this work coordinated with the other Services and SDI?

Answer. Great effort is expended to ensure that DARPA's work in this area is well coordinated with all the Services and SDIO by numerous working groups and coordinating committees. This is, of course, to DARPA's advantage since transition to the military is ultimately the goal of every DARPA program.

AIRSHIP

Question. The Congress provided $30 million last year for continued development of the airship for Naval missions. What is the status of these funds?

Answer. Of the $30 million appropriated, $15 million has been obligated on the contract. The remaining $15 million (including $1.6 million for Navy support) has been placed on deferral by the OSD comptroller as a result of their finding that the funds were appropriated but not authorized by Congress.

Question. Are all requirements under the existing contract fully funded?

Answer. No. The current contract required a payment of $65 million on 1 October. The $30 million in the FY90 appropriation allowed continuation of the design effort but does not provide for long-lead procurement items for Airship construction.

Question. Are additional fiscal year 1991 funds required to complete the contract?

Answer. Yes. Funding levels of $65 million in 1991 and $48 million in 1992 are required to complete the design and fabrication of the YEZ-2A Airship under the current contract.

Question. Once the contractural effort is completed, what will be done with the equipment and technology delivered under the contract?

Answer. The current plan is to use the YEZ-2A Airship as an airborne early warning (AEW) platform for evaluation of an advanced design radar and combat system. Additional missions would include command and control, anti-submarine warfare and drug interdiction.

Question. Discuss the technical progress that has been made so far.

Answer. The preliminary engineering design of the airship and ground support equipment has been completed and approved by the Navy and DARPA. Additionally, a successful critical (final) design review was completed on the envelope, flight controls and electrical power generation system. The remaining final design reviews will be held over the next 12 months in preparation for fabrication of the Airship. The first flight is scheduled for late 1993 or early 1994. No significant technical issues have been identified to date.

STEALTH PAINT

Question. The Committee provided $1 million above the budget request last year to evaluate a paint product that may offer advantages in the construction of low observable weapons. The product is manufactured by a company called Carolina Solvents. Describe the "microbubble" technology that this company has developed?

Answer. ———.

Question. What advantages might this technology offer in terms of cost and weight of low observable materials?

Answer. ———.

Question. What is the status of the funds Congress appropriated in fiscal year 1990 for this purpose?

Answer. An initial classified contract was awarded in February 1990 for $300,000. DARPA is in the process of evaluating a second contract for appropriately $200,000 and a contract award is anticipated shortly. The remaining $500,000 is expected to be obligated by the end of fiscal year 1990. Work is ongoing to establish a coherent program that will most benefit the DOD and take advantage of expertise throughout the country.

Question. Are additional funds required in fiscal year 1991 to continue the evaluation and development of this technology?

Answer. If additional funds are needed in fiscal year 1991, they will come from our requested appropriation.

Question. What other similar programs does DARPA have underway?

Answer. The work involved is at a highly classified level.

[CLERK'S NOTE.—End of questions submitted for the record.]

THURSDAY, APRIL 26, 1990.

STRATEGIC DEFENSE INITIATIVE

WITNESSES

LT. GEN. GEORGE L. MONAHAN, JR., DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

DR. O'DEAN P. JUDD, CHIEF SCIENTIST, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

INTRODUCTION

Mr. **MURTHA**. The committee will come to order.

We want to welcome Lt. General George Monahan, Director of the Strategic Defense Initiative Organization, to the committee and commend him for his work. The fiscal year 1991 budget requests $4.5 billion in the Defense bill for SDI, an increase of $.9 billion or about 25 percent from the fiscal year 1990 appropriation of $3.6 billion.

General, we understand you are retiring in July, and we certainly want to express appreciation on the part of the committee for the tremendous job you have done. We are so impressed by the work that has been done and the progress that has been made in this area. We probably won't be able to fund it at the levels requested by the Administration, but we certainly have made magnificent strides under your leadership. We have a great admiration for your work and you have inspired all of us with your dedication to this very complicated world which we call SDI.

We will put your full statement in the record and if you would summarize it for us, we will then have questions.

SUMMARY STATEMENT OF GENERAL MONAHAN

General **MONAHAN**. Thank you very much and thank you for those very, very kind words. It has been a fantastic experience to have spent close to 35 years in the United States Air Force. It has been a pleasure also to have spent the last assignment in my career on this great program and with so many great people, including Members of the Congress, on SDI. I would like to summarize my statement for a few minutes.

NATIONAL SECURITY DIRECTIVE

When the committee met last year, the President had not yet issued his National Security Directive that addresses SDI, but he did so in June of last year. In that directive, the President told us that he wanted to be in a position to make an informed decision on deployment of SDI within four years—mid-1993.

In the meantime, he told us to continue research on a system that would have ground-based and space-based layers associated with it and that would be able to meet the requirements that the Joint Chiefs had laid down for the first phase.

He told us to look hard at promising new concepts such as Brilliant Pebbles, to intercept missiles in the boost and post-boost phases of the flight of a ballistic missile and fund the program such that it would be technology—but not financially—limited. This program would be conducted in accordance with the ABM Treaty and we are doing that in compliance with a stricter interpretation of the treaty.

The President also said to try and maintain the schedule for initial deployment that had been part of the previous program from the previous Administration that would have allowed us to initially deploy defenses in the late nineties. We have taken action to do so and by fully funding the Brilliant Pebbles concept, we are able to make all of that happen. So that is basically the approach and that is what is covered here within this statement.

BRILLIANT PEBBLES

By adopting Brilliant Pebbles, we were able to reduce the cost estimates we have at this time for the first phase of the program. The more conventional space-based interceptor system, one with heavy reliance on outside sensors, was estimated at $69 billion. With Brilliant Pebbles, that is down to $55 billion. We are looking at further opportunities for reducing costs of the system and adopted the Brilliant Pebbles approach.

This year, we are going to look hard and do another review of the ground-based portion and look at the way that the ground-based and space-based elements contribute in what we call the mid-course phase of a ballistic missile intercept. Those efforts are ones that we are just initiating at the present time. By the way, that particular study effort was recommended in an independent review that, Mr. Chairman, was headed up by Ambassador Cooper, so that further buttressed what we want to do.

SDI FUNDING

What we are seeing now with the investment of approximately $20 billion so far in SDI over a period of about the last six years, we are moving from the drawing board and design tables and from the laboratories into an era in which we have major tests and major experiments taking place. By so doing, we plan to be able to support the President in making a deployment decision in the 1993 time frame. I think we have reasonable cost projections for such a system and I think more importantly the technology is now at hand such that we can, with confidence, say that it would be possible to do initial deployment of a Strategic Defense System within this decade.

The American Institute of Aeronautics and Astronautics, the Defense Science Board, the Jasons University Group, and other groups have looked at the program over the past year or so and they don't see any technical showstoppers. These studies do point out that there is a tremendous engineering job that has to be done and there are problems and challenges ahead in an engineering sense, but no fundamental issues in a technical sense.

So the issues are the very important ones of policy, strategy, economics and finance.

Mr. Chairman, I believe that briefly summarizes what my statement has to say. With that, I would be happy to answer your questions.

[The statement of General Monahan follows:]

Statement On

THE STRATEGIC DEFENSE INITIATIVE

By

Lt Gen George L. Monahan, Jr.
Director
Strategic Defense Initiative Organization

Before The
Subcommittee On Defense
Committee On Appropriations
House Of Representatives

101st Congress, Second Session

April 26, 1990

INTRODUCTION

Mr. Chairman and Members of the Committee, I am pleased to appear before you today to speak in support of the Strategic Defense Initiative (SDI) budget request and to answer any questions you may have about the program.

The SDI program is in its sixth full year of research to determine the feasibility of effective defenses against ballistic missiles, and we continue to make excellent progress across a broad range of technologies. During FY 1989 we conducted a record number of major experiments and tests crucial to program success. We will break that record in FY 1990 and, with your support, surpass it in FY 1991 (Figure 1). The growing number of tests and experiments demonstrates that the program is moving away from paper feasibility studies, laboratory work and infrastructure development which characterized prior years. We are now moving into the testing of hardware, thus capitalizing on SDI investments. I shall discuss some of the more important program developments later in my statement.

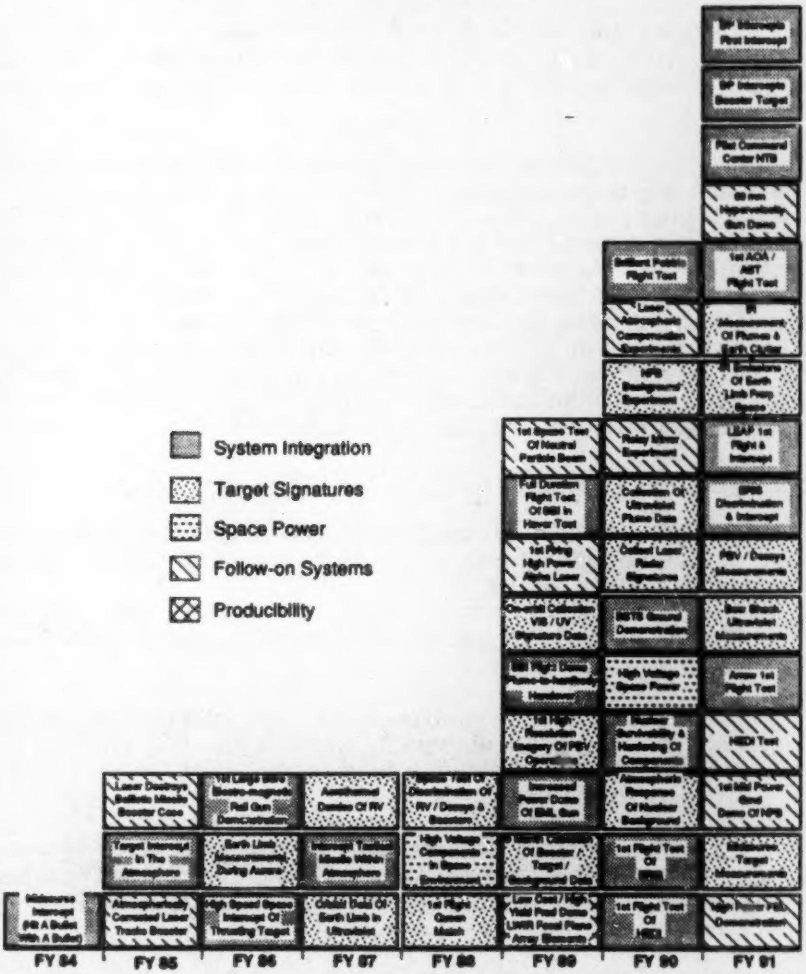
FY 1991 PROGRAM BASIS

The FY 1991 SDI budget request submitted to the Congress by the President on 29 January 1990 is structured around the following Presidential guidance:

- Provide for an informed decision on deployment within three years.
- Pursue options for layered defenses, consisting of both space and ground-based elements, which offer the promise of meeting the requirements issued by the Joint Chiefs of Staff (JCS) for Phase I defenses.
- Expedite research and development of promising defense concepts (such as Brilliant Pebbles) that could intercept missiles during the boost portions of their flight. Pursue other Phase I space-based system components as a back up.
- Conduct the program in full compliance with all U.S. international obligations, including the Anti Ballistic Missile (ABM) Treaty.
- Structure the program to permit deployment of layered defenses on a schedule as close as possible to that envisioned

in the FY 1990-1994 Five Year Defense Plan submitted to the Congress on January 9, 1989.

FIGURE 1
MAJOR TECHNICAL ACCOMPLISHMENTS



I would like to take a few minutes to discuss each of these five points in some detail.

PROVIDE FOR AN INFORMED DECISION ON DEPLOYMENT

To support this decision, the FY 1991 SDI program is structured to continue research and development on a broad range of maturing and advanced technologies. Research to demonstrate and validate elements of the Phase I system is balanced with tests and experiments for follow-on concepts such as directed energy technologies. The program is focused on reducing technical risk in areas such as target signatures against a variety of backgrounds, communications, radiation hardening, space power, and system integration. The program is also focused on reducing costs in areas such as optics, focal plane arrays, light weight materials, and launch. The overall approach is intended to provide the decision makers with information on initial defenses and options for future capabilities to enhance initial defenses should this prove necessary.

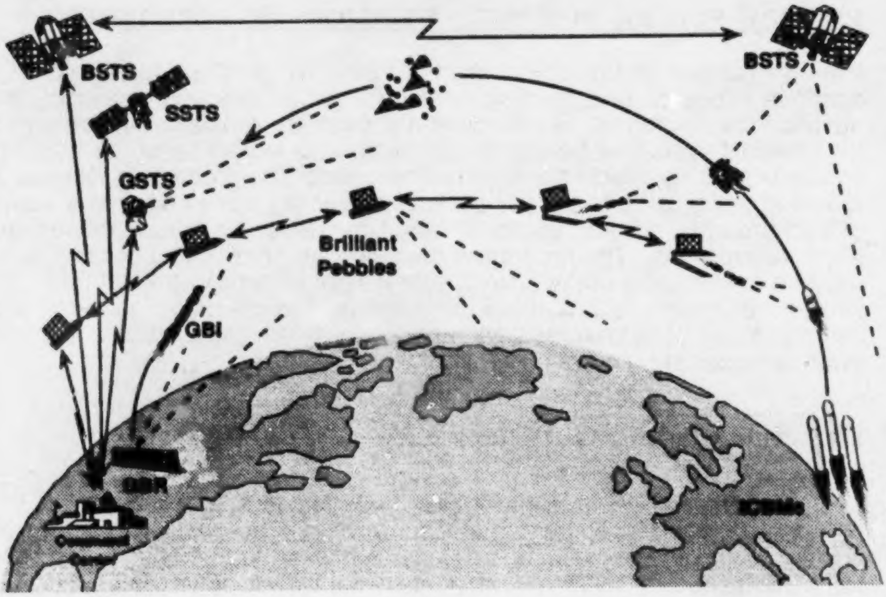
LAYERED DEFENSES TO MEET JCS REQUIREMENTS

The Phase I system has been designed to serve as the first in a potential series of deployments leading to a more balanced deterrent posture based on offensive and defensive forces. With this understanding, the JCS issued in 1987 a formal statement of mission objectives and required system characteristics for Phase I. These requirements provide guidance for establishing the architecture explained in prior budget requests and depicted in Figure 2.

The architecture selected is consistent with the findings and recommendations of the 1984 Fletcher Study on SDI, and subsequent studies have confirmed that it is a sound approach. It is a two-layer system consisting of both ground and spaced-based interceptors and sensors and their supporting systems.

I would also like to review for the Committee the rationale for pursuing layered defenses. As you know, layered defenses are those which engage attacking missiles in more than one portion of their trajectories. The significant benefit to layered defenses is that they are highly effective against a variety of attacks and are less vulnerable to possible countermeasures. The FY 1991 SDI program is consistent with this rationale. First, our research is aimed at space-based kinetic and directed energy weapons and sensors for the high payoff, boost/post boost region where a single hit by a defensive weapon could destroy multiple attacking warheads and their decoys. Second, we are examining ground and space-

Figure 2
SDS PHASE ONE ARCHITECTURE

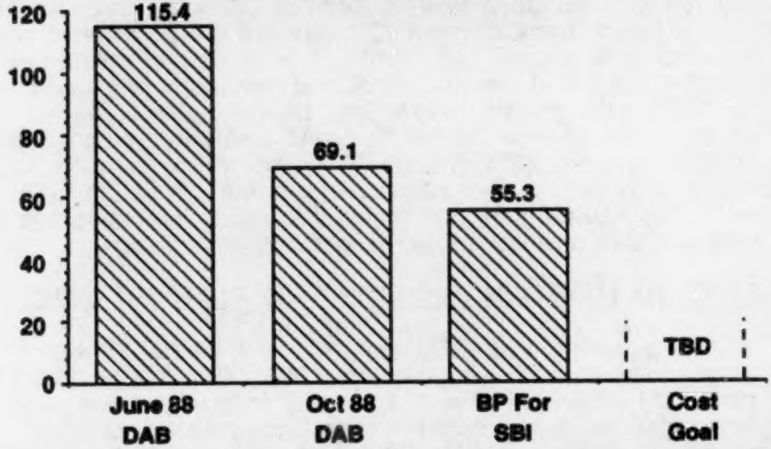


based kinetic and directed energy weapons and sensors to detect and destroy warheads during their relatively long flights in the midcourse region. Additionally, we will explore ways to destroy warheads as they reenter the atmosphere in the terminal region.

EXPEDITE RESEARCH OF PROMISING CONCEPTS (BRILLIANT PEBBLES)

The Brilliant Pebbles concept consists of a light-weight, low-cost, single hit-to-kill kinetic kill vehicle that provides integrated sensors, guidance, control, and battle management. During FY 1989, this autonomous, highly survivable, space-based defensive interceptor concept was independently reviewed by a Department of Defense Space-Based Architecture Study Group, by the distinguished JASONS panel of scientists, and by the Defense Science Board. The concept was found to be innovative and capable, with no fundamental flaws, and deserving of continued support. Initial cost estimates show that Brilliant Pebbles could reduce the cost of a Phase I system by at least 20% (Figure 3). I believe that these estimates are conservative, especially in light of the opportunities for innovation in manufacturing technology for producing large numbers of identical Pebbles. I also believe that the strategy we have selected for developing this concept will take advantage of these opportunities.

Figure 3
SDS PHASE I COST COMPARISONS
(FY 88 $ IN BILLIONS)



We launched in FY 1990 a multiple-contractor competition for concept definition. My office, with the cooperation of the Lawrence Livermore National Laboratory, will manage this highly streamlined program. The program is designed to bring industry on board and at the same time maintain the simplicity and low-cost features of the concept. A follow-on design competition will be initiated in FY 1991. To obtain maximum benefit from contractor innovation, we are not imposing military specifications or standards. Requests for proposals and contracts will state requirements in a simple fashion, and contractor reporting requirements will be minimized.

Additionally, given Brilliant Pebbles potential for independent operation, the role of the Boost Surveillance and Tracking System and the Space Surveillance and Tracking System in the Phase I architecture is being reassessed. Although these sensors are definitely needed for non-SDI missions, the Phase I architecture with Brilliant Pebbles may not require these sensors or may require less capability from them. This outcome could further reduce the cost of a Phase I system.

In line with Presidential guidance and Defense Science Board recommendations, we will continue research and development on more conventional space-based interceptor concepts.

TREATY COMPLIANCE

The Department of Defense has in place an effective compliance process under which the Undersecretary of Defense for Acquisition, in consultation with the Department's General Counsel, Undersecretary of Defense for Policy, and Chairman JCS, ensures that all defense programs are in compliance with all U.S. strategic arms control obligations. SDI experiments, tests, and other research and development efforts proposed for FY 1991 will, prior to execution, be carefully screened by the Department's Compliance Review Group to certify that planned activities fully comply with the ABM Treaty. This compliance process has been followed in all previous years of the SDI program. Additionally, I, as the Director of the SDI program, am required to certify continued compliance quarterly and have established internal procedures to do so.

ATTEMPT TO MAINTAIN JANUARY 1989 PLANNED SCHEDULE

Planned funding for the SDI program for FY 1990 through FY 1994 was reduced substantially after January 1989. The President understood that this could adversely impact our ability to maintain the pace of the program. Yet, he asked that we try. I am pleased to report to this Committee that we have, to a large extent, been successful. We did this by making things simpler and cheaper. Incorporation of advances in technology, the inclusion of Brilliant Pebbles in the space-based segment of the Phase I architecture, and judicious use of available resources has, so far, allowed us to maintain the program balance and pace needed to support a decision on deployment and to maintain an option for initial deployment in this decade. Our ability to continue on this path clearly depends on the level of funding for FY 1991 and beyond.

SDI PROGRAM PROGRESS

When SDI was initiated, this nation's experience with ABM systems was limited primarily to 9 months of operation in the 1970s of the Safeguard ABM system at Grand Forks, North Dakota. The Safeguard system employed nuclear-tipped missiles and large ground-based radars. Because of technology limitations in areas such as computer guidance, sensors, optics, and miniaturization, we could then not achieve the accuracy needed to realize direct hit-to-kill, which eliminates the need for a warhead of any kind. We also knew there were important issues with system survivability and battle management. When Safeguard was abandoned, few predicted the large and rapid advances in technology that have permitted ballistic missile defenses to re-enter our national security equation.

Times Have Changed

- In 1984 we hit a 'bullet with a non-nuclear bullet" using a ground-based interceptor and on-board passive infrared sensor for terminal guidance to destroy a simulated reentry vehicle launched from a ballistic missile.
- In 1986 we validated guidance laws in space by destroying a thrusting target. This simulated an intercept in the boost portion of a ballistic missile's trajectory.
- In 1987 the Flexible Lightweight Agile Guided Experiment demonstrated that a reentry vehicle could be intercepted in the atmosphere using a radar-guided interceptor.
- In January of 1990 the first High Endoatmospheric Defense Interceptor flight test demonstrated our ability to effectively cool a terminal interceptor's forebody and sensor window. This is a crucial step toward demonstrating that the sensors will not be disabled by heat from atmospheric friction. Until this flight test, many in the technical community believed that effective window cooling could not be achieved.

To intercept a missile or reentry vehicle, defenses first must detect, discriminate, acquire, and track the targets under a variety of conditions. Early in SDI we established, and we continue to operate, a broad-based program to collect target signatures. This program includes numerous sounding rockets and rocket-launched satellites to put up sensors to view targets and decoys against different earth and space backgrounds. It also includes various airborne, shipborne, and ground-based sensors to collect signature data. (Examples of airborne platforms are an NC-135A equipped with sensors that operate in the visible through long wavelength infrared bands and a Lear jet equipped with ultraviolet through medium wavelength infrared sensors.) Further, we have an aggressive program to explore and develop passive, active, and interactive discrimination technology. This program is supported by activities which build and test various decoys and penetration aids to see what will "stress" the system. Some specifics will illustrate our accomplishments in these areas.

- Throughout the 1980s our Delta 180 series detected, acquired, and tracked numerous targets including boosters, reentry vehicles, and decoys.

- In 1988 we collected our first infrared data on foreign targets in the QUEEN MATCH flight, and conducted many sounding rocket tests to evaluate decoys, countermeasures, and the effectiveness of discrimination.

- In 1989, in the JANUS experiment, we used high resolution infrared imagery to collect target signatures of post-boost vehicles.

- Also in 1989, with our space-based interceptor hover test, we integrated a host of technologies and demonstrated the full capability to acquire and track a rocket plume, then transition to tracking the rocket hard body. This capability is absolutely essential for boost and post-boost intercepts.

- In 1990 we will demonstrate that we can detect boosting targets of all intensities of interest against a variety of earth backgrounds.

Much progress has also been made in ensuring that defenses can be integrated and managed, always with man-in-the-loop, and that they are survivable.

- The National Test Bed has been established to develop, test and validate strategic defense concepts and software.

- We are building high-fidelity end-to-end simulations that allow defense concepts to be tested against a variety of realistic threat models. This effort provides early user involvement in the development of command and control concepts.

- An early version of a command center was successfully demonstrated at the Army Research Center. This program showed that, with man-in-the-loop, there is sufficient time to assess, react and engage attacking missiles throughout the battlespace.

- We have established a software center of excellence to address the large scale integration of software for a defensive system.

- To ensure that systems can operate reliably in the adverse environments caused by nuclear weapon detonation, we validate the survivability of system components, such as electronics, optics and structures, through experiments on underground nuclear tests.

- Red/Blue team analyses are conducted to examine the ways in which an attacker may try to defeat the defenses, and to establish effective measures to offset those attempts. Results are then fed back into efforts to design both the system and its operational concepts.

Most of the progress discussed so far relates to Phase I. However, progress in advanced technologies, such as directed energy, has also been impressive. The key issues being examined are target acquisition, pointing and tracking, generation of high power lasers and particle beams, and beam lethality.

- In 1985 we demonstrated at low power the capability to both track a rocket in space and to propagate a laser beam through the atmosphere without significant distortion. In several other experiments, we proved lasers are lethal weapons for destroying both solid and liquid propellant missiles.

- In 1986 our first particle beam experiment irradiated a miniature reentry vehicle with a high intensity proton beam. The results indicated that the explosives contained in a reentry vehicle are detonated by such beams.

- Early in the program many experts had stated that building large optics would be impossible and prohibitively expensive. In 1988 we built a high quality mirror, the first large diameter segmented mirror with a surface that is controlled electronically. That mirror will be integrated into a ground test in 1991.

- In 1989 the Alpha Chemical laser for the first time produced a high-power beam when fired in its ground test facility. This milestone in the space-based, chemical laser program is being used to validate the technology, computational methods, and fabrication processes necessary for scaling chemical lasers, configured for space basing, to power levels required for a strategic defense.

- In 1989 our Beam Experiment Aboard Rocket conducted the first test in space of a neutral particle beam. It employed a relatively light-weight power supply which can be packaged for space operation. It demonstrated that complex directed energy weapons could be reliably operated in space.

- In February of 1990 we launched the first long-term directed energy space experiments from Cape Canaveral. The 2-1/2 year Low-Power Atmospheric Compensation Experiment, known as LACE, will measure the atmospheric distorting effects on laser beams. The 1 year Relay Mirror Experiment, known as RME, will demonstrate the relay element of a ground-based laser.

- The Talon-Gold ground test demonstrated our ability to place a beam on target very accurately The next challenge is to do it in space, an experiment currently planned for 1992. The precision we are demonstrating in these experiments is equivalent to firing a laser from high above the Empire State building to hit a volleyball on a California beach.

Our research into defense systems has also yielded tremendous technical progress in areas such as miniaturization, reduced manufacturing cost, and light weight structures.

- Efforts in navigation technology have ushered in a whole new class of miniaturized inertial measurement units for navigation and guidance in the 1990s. Bulky units that weighed tens of pounds in the past will weigh only ounces in the future, with costs reduced by a factor of ten.

- We are learning how to manufacture large quantities of infrared detector elements, known as pixels, at greatly reduced costs. Prior to SDI, the costs of such pixels were in the range of hundreds of dollars each. Today we are looking at a range of a few dollars to a fraction of a dollar.

- Our work on making stiff, high-performance trusses and tubes from advanced composite materials provides one example of developing lightweight, high strength structures for space platforms.

These and other advances have been exploited to reduce the costs and enhance the performance of prospective strategic defense systems.

Additionally, our research has yielded a wealth of spin-off applications of SDI technology.

- An outgrowth of our free electron laser program is medical use of lasers to remove burn and scar tissue, break up kidney stones, and treat heart disease and cancer.

- Some of our laser work also contributed to a blood bank purification process that cleanses donor blood bank supplies of infectious viruses.

- SDI-developed carbon material for use in orthotic braces will double the strength and reduce the weight by two-thirds when compared to conventional steel braces.

- Our work on optical technologies could lead to a new generation of very high speed, low cost supercomputers.

- SDI neutral particle beam technology may have applications in areas such as airport detection of explosives, cancer therapy, and non-destructive inspection of manufactured items such as rocket motor components.

- SDI research is creating commercial opportunities in superconductivity, diamond crystal coatings, communications, industrial manufacturing processes, electronics, and microwave technology.

- SDI hypervelocity gun technology may be utilized for mass transfer of materials from the lunar surface to low earth orbit.

- The National Aeronautics and Space Administration's Space Station and National Aerospace Plane should benefit from SDI advances in computing, signal processing, and light weight structures.

- SDI technology may have other defense uses such as reducing the weight and cost of air-to-air missiles. Hypervelocity gun and directed energy technology could also be used in the theater battlefield.

As you can see, Mr. Chairman, SDI technical progress during the 1980s has been very impressive across a broad range of technologies.

FY 1991 BUDGET AND PROGRAM HIGHLIGHTS

I will turn now to the highlights of our FY 1991 budget and program. The Fiscal Year 1991 budget request for the SDI program is $4.47 billion. Although this is an increase of $870 million over the FY 1990 appropriation, it is a $1.0 billion reduction from the FY 1991 budget included in the FY 1990/1991 budget request last year. Our major technical plans are discussed next.

Development of the Boost Surveillance and Tracking System (BSTS) missile launch warning satellite is on track. The system is scheduled to enter full-scale engineering development in FY 1991, subject to a successful ground demonstration in FY 1990. BSTS is essential to the national mission of tactical warning/attack assessment and other missions. However, its role as a critical node to strategic defense has diminished with the adoption of Brilliant Pebbles. The first launch of a full-scale development vehicle is planned for the mid-1990s.

The BSTS program was created prior to SDI to resolve long standing deficiencies in the Defense Support Program (DSP). As the follow-on to DSP, BSTS is necessary in order to satisfy validated TW / AA requirements. BSTS satisfies concerns in areas of survivability (of satellites and ground assets), decentralization of tactical information (through direct reporting to users), assured worldwide coverage (no solar or geographic gaps), and more warning time (through increased sensitivity and quicker reporting times). Application in BSTS of today's state-of-the-art technology frees the early warning system from overseas bases, requires fewer personnel to operate, provides more detailed information to using commanders, and has a lower life-cycle cost. BSTS will complete its demonstration and validation phase next year. The program, fully ABM Treaty compliant, is ready to enter FSD to fulfill the TW / AA mission. Concurrently, BSTS is structured to protect a decision for possible future use within strategic defenses. Delaying start of FSD continues identified TW / AA shortfalls (through delayed transition from DSP), adds costs (both in the form of increased overall BSTS program costs and additional DSP satellite and continued multiple ground station costs), and jeopardizes our investment (approx $1B to date) and the industry base currently in place to carry development forward. Finally, delay in the start of FSD in 91 will bring us back to this table next year with the same issues but with no additional information; only higher costs.

The High Endoatmospheric Defense Interceptor is the most advanced concept being considered for terminal defense. It is a ground-based, hypervelocity, high acceleration interceptor designed to destroy ballistic missile reentry vehicles high in the atmosphere. It is both a potential follow-on to Phase I and a back up to the Ground-Based Interceptor. The High Endoatmospheric Defense Interceptor also has strong potential for theater defense. During the remainder of FY 1990 and in FY 1991 we will prepare to conduct a second flight test to verify target acquisition and tracking functions, control and guidance systems, and seeker window survivability.

In FY 1991 we will also continue construction of the technical facilities for the Free Electron Laser Accelerator, Wiggler, and Beam Control System at White Sands Missile Range in New Mexico. When completed (in approximately FY 1993), it will be available to house the high power laser required to conduct the technology integration experiments needed to validate the concept.

As I mentioned previously, during FY 1991 we plan to conduct a record number of major tests and experiments (16). These will encompass a broad range of technologies, and they include:

- The first intercept by a Brilliant Pebbles experimental vehicle;
- Major phenomenology experiments to collect vital signature and environmental data in support of the target acquisition, tracking, and discrimination functions;
- A pulsed high power concept demonstration of a free electron laser device;
- A full power test of the neutral particle beam ground test accelerator at Los Alamos; and
- The first flight tests of the Arrow theater defense experimental interceptor. Arrow is a good example of an allied cooperative program.

THEATER DEFENSE AND OUR ALLIES

Mr Chairman, before concluding, there are two other important topics related to the SDI program that I would like to address. These topics are theater defense and the participation of our allies in the SDI program.

The SDI charter reflects a concern for both U.S. and Allied security and stresses development of defensive technologies for ballistic missile threats of all ranges. The FY 1991 program would continue our theater defense program that includes examination of architecture studies, technology demonstrations, tests, and the development of test beds to explore alternatives which could provide a defense against theater-class ballistic missiles. Allied participation has enhanced our understanding of theater defense problems.

In fact, Allied participation in theater defense and other SDI research has proven beneficial to both the SDI program and to our Allies. We have also recently signed several cost-sharing, project-specific cooperative research commitments with the Allies. Allied participation contributes to the attainment of SDI objectives, and we will continue to cooperate with our Allies on many aspects of the SDI research program.

CONCLUSION

In conclusion Mr. Chairman, I believe that the most significant evidence of progress during the six year history of the SDI program is that we now have:

> A Phase I architecture that will meet the requirements for strategic defense, based on technically achievable sensors, command and control capability, and interceptors;
>
> Reasonable cost projections for such a system;
>
> A set of technology development projects that support Phase I as well as follow-on systems that could employ advanced concepts such as lasers and neutral particle beams; and
>
> A national strategic defense research and development infrastructure, staffed with extremely talented and dedicated professionals, that stands ready to resolve the remaining technical and engineering issues of strategic defenses.

A team of experts from the prestigious American Institute of Aeronautics and Astronautics Society spent a year looking at our program. This was the first group to review our entire program, including Phase I, follow-on systems, and our technology efforts. They said, "no fundamental obstacles were found." Deployment of a Phase I system depends on the resolution of technical issues currently being addressed. The engineering task remaining is challenging, but it can be accomplished.

SDI research is an excellent investment. That is why, in an era of scarce defense resources, the President is so supportive of the program. We continue to show impressive results. You can be assured that significant technological advances which occur in the future will be exploited to further reduce the cost and improve the performance of a prospective strategic defense system. Our past record amply supports this commitment.

Mr. Chairman, I believe that in the first six years of the SDI program we have demonstrated that our capability to develop and deploy effective defenses is constrained not by our ability to overcome technical hurdles, but by the funding we receive. I therefore urge you and the Members of the Committee to support our full budget request. With your backing, we can continue a balanced and vigorous program of research and development leading to deployment of strategic defenses for our nation.

I will be happy to answer any questions you may have.

OPENING REMARKS

Mr. MURTHA. We have two Members who have been working on this project for us trying to become knowledgeable so they can advise us. Mr. AuCoin is not here now, so we will turn to Mr. Livingston and ask him to lead off with questions.

Mr. LIVINGSTON. Thank you, Mr. Chairman.

I will get into some preliminaries. I know Mr. AuCoin wants to get into pretty detailed specifics and I will try to avoid that until he gets here.

Mr. MCDADE. Would you yield for a second because I would like to reflect on the record that, General, your 35 years of service to the Nation are unsurpassed. You have been in front of this committee so many times and it is the Nation's and the Air Force's loss that you have finally seen fit to follow some bluebirds. I can't blame you, but you have our enthusiastic thanks for your tremendous career in public service and we are grateful for all your efforts in difficult times. You have been a great witness in front of this committee over the years and we appreciate all you have done for this country.

Mr. LIVINGSTON. I concur in those remarks and wish you the best, General.

Let me also say that I have had the chance to make two trips around the country with the SDI office, with Dr. Judd and to the various sites which are producing the elements of the SDI program, and I have become convinced that it is an extremely cost-effective defense against threats that will confront this Nation in the future and today, and I think we are getting a foothold with this program into something that will protect our people for a long time to come.

It is a good program, and you have got some brilliant people working on it.

We give the accolade of Brilliant Pebbles to the program, to the entire system, but that accolade really is more properly assigned to the people that have developed this program, and I just want to say how impressed I am with all of the folks that have contributed so greatly to the future of this Nation.

PHASE I SYSTEM

Let's discuss the cost of the Phase I system.

In 1987, SDIO estimated that cost to develop, procure and deploy the approved Phase I architecture would cost $146 billion in constant fiscal year 1988 dollars. By June 1988, this changed to $115 billion. Last year, the estimate was $69 billion, and as you indicated in your opening statement, it has now recently dropped to $55 billion using the Brilliant Pebbles approach.

To what do you attribute the dramatic decrease in Phase I system acquisition costs?

General MONAHAN. The cost decreases are associated with changes in the architecture and looking at ways that we can basically and fundamentally make the program simpler.

A good example of that is, of course, the Brilliant Pebble.

The Brilliant Pebble interceptors, we estimate, would cost between $1.1 million and $1.4 million apiece.

Coupled with that, the Pebbles have the capability to operate in an autonomous mode—other than having man in the loop to activate the Pebbles—so they do not have dependency on other sensors in the system.

It is those simplifications in the architecture that made the cost go down.

BOOST SURVEILLANCE AND TRACKING SYSTEM (BSTS)

Mr. **Livingston**. Is there a decision as to whether BSTS will remain in the system?

General **Monahan**. That is very important for the tactical warning and attack assessment.

We do not need it as an essential element of the strategic defense system with Brilliant Pebbles having its autonomous capability for surveillance and target acquisition and tracking, so BSTS is not essential to an SDI, but very essential for the tactical warning and attack assessment to be able to ———.

Mr. **Livingston**. So whether we deploy a strategic defense or not, we still have to have an early warning system, a tracking system which tells us when the rockets would be fired and where they might be going?

General **Monahan**. Yes, indeed. It is essential for a national purpose, a tactical warning and attack assessment. That is its main reason for existence.

PHASE I SYSTEM COST

Mr. **Livingston**. The statement indicated that the Phase I system cost is "to be determined." Can you tell us what you meant by that?

General **Monahan**. Yes.

First of all, we have it now down to a figure of $55 billion as our estimate for the first phase, and that is after we did the review of the space-based architecture this past year. Now we are about to undertake a review of the midcourse intercept problem, that looks at the ground-based architecture and some of the space-based systems. I think we will find some opportunities there to further reduce costs. I am hoping that we will be able to simplify that architecture.

I think there is an opportunity, I don't know for sure just how successful we might be with that, but we are certainly going to try. That is an effort that we are just initiating at the present time and we will conclude this fall.

Mr. **Livingston**. We have some additional questions about cost.

[**Clerk's note**.—Questions submitted by Mr. Livingston and the answers thereto follow:]

Question. In 1987, SDIO estimated that costs to develop, procure, and deploy Phase I architecture would cost $146 billion in constant fiscal year 1988 dollars. By June, 1988 this changed to $115 billion. Last year the estimate was $69 billion. Your statement indicates it has recently dropped to $55 billion, using the "Brilliant Pebbles" approach.

What caused such a dramatic decrease in Phase I system acquisition costs?

Answer. The acquisition costs for Phase I of the Strategic Defense System (SDS) is currently $55.3 billion in FY88 dollars. This cost reflects the utilization of the Brilliant Pebbles concept as the space-based interceptor. The use of the Brilliant Pebbles concept allows for a less complex Space-based Surveillance and Tracking System (SSTS) and also lower launch costs. The number of Ground-based Surveillance and Tracking System (GSTS) vehicles is increased to compensate for SSTS reductions. The lowering of the acquisition cost of SDS Phase I is the result of technological progress and the system engineering process. Technological progress has offered new options for the SDS Phase I architecture. The system engineering process, focused on cost and effectiveness, has evaluated these options and allowed for the evolution of the SDS Phase I architecture along a consistently less expensive path.

Question. Your statement indicates that the phase I cost goal is "TBD (to be determined)". What does this mean? At what level would Phase I costs be reasonable and acceptable to you?

Answer. I have already reported that the current acquisition cost estimate for a Phase I Strategic Defense System is $55.3 billion (in constant FY 1988 dollars), and that I expect this estimate to be reduced further. My expectations are based on the inclusion of Brilliant Pebbles in the architecture with the resulting potential for: (1) reassessing the role of some sensor elements or requiring less capability from them, (2) contractor innovation in designing the concept, and (3) economies of producing thousands of identical Pebbles. In addition, I have initiated studies to explore applying BP technology and the BP acquisition approval to other SDS concepts. Until these studies are complete, additional development work accomplished, and final element and system designs approved, it is premature to establish cost goals.

I have also reported that the technology to produce and deploy a Phase I SDS is at hand; and that only the engineering work remains to be done.

Question. Using the current $55 billion constant dollar estimate, what is the actual "then-year" cost for the Phase I system?

Answer. The current "then-year" dollar estimate for the acquisition of Phase I of the SDS is $68.7 billion. This estimate is based on initial schedule estimates for the revised program and is sensitive to changes in funding allocations and schedule objectives.

Question. What is the Phase I "life cycle cost"? That is, how much additional O&M cost is involved for the life of the Phase I system that is not addressed in the "acquisition" cost estimate of $55 billion?

Answer. The current O&S estimate for ten years of support is $17.6 billion-FY 1988, with an additional O&S "wedge", the O&S funds expended before system FOC, of $7.9 billion FY 1988. This gives a system life cycle cost estimate of $80.8 billion-FY 1988.

Question. Brilliant Pebbles places many more objects into space than does the baseline phase system approved by the Defense Acquisition Board. Won't this drastically increase the O&M (and therefore life cycle) costs of the Phase I system, in order to monitor the health and position of many more objects than the baseline system?

For the record, please provide life cycle cost estimates for each approach.

Answer. The October 1989 CAIG estimate of total O&M costs for the Brilliant Pebbles is $3.1 billion-FY 1988 for a 10 year life cycle. The Space Based Interceptor (SBI) O&M estimate approved at the October 1988 DAB is $4.0 billion-FY 1988. The major components of these costs are replenishment spares and risk. The cost of monitoring health and position is only a small fraction of either estimate.

Replenishment and risk costs account for over two-thirds of the O&M bill. The estimated cost of BP replenishment is less than the 1988 SBI estimated replenishment costs for the following reasons:

The BP constellation configuration is more resilient. Therefore, fewer replacements are needed.

More robust System Test & Evaluation (ST&E) is planned for the BP. The ST&E program should yield more reliable units.

Due to system simplicity and production efficiencies, the unit cost of an additional BP is less than the cost of an additional 1988 SBI design unit.

The cost of monitoring of health and position of space-based systems is driven by personnel requirements. Personnel costs made up less than 10% of the O&M estimate in either case. Personnel costs were estimated to be less for BP than for the 1988 SBI design due to BP's relative simplicity and to the resilience of the constellation. O&M personnel requirements do not have a large impact on BP life cycle costs. Even a 100% growth in the BP O&M personnel cost would result in less than 2% increase in BP life cycle cost.

[CLERK'S NOTE.—End of questions submitted by Mr. Livingston.]

COST TO COUNTER SDI

Mr. LIVINGSTON. While we are talking about the cost to the United States and how the cost for an effective defense system is being reduced, I think it is also significant to talk about how the cost for a counter to that defense system might go up. I refer specifically to an article attributed to Defense News of March 26, 1990, which I think I will read into the record. "A new analysis by the Defense Intelligence Agency shows that the Soviet Union's cost of countering the SDI is far greater than earlier official estimates." Skipping down, "the DIA analysis shows that the Soviet response to SDI would cost six to seven times the lifecycle cost of SDI for initial investment alone. The ten year system cost of a Soviet response posture would be well in excess of the dollar equivalent of $1 trillion according to the abstract of the analysis."

The article goes on to discuss the various scenarios of how they, the Soviets, might send up 7,000 warheads, or however the Soviet might choose to attack us. In addition, one offensive missile, or concept, that could be used to counter SDI would be the depressed trajectory submarine-launched weapon. The person responsible for this article is saying that we have examined the depressed trajectory threat and there is nothing we consider within the SDI program to be a showstopper that we cannot completely deal with.

General MONAHAN. Right.

Mr. LIVINGSTON. Do you concur with those remarks?

General MONAHAN. I do.

The ratio you cited of six to seven to one, as I recall, is consistent with other studies that have been completed. There are other studies I have seen that show the ratio at more than ten to one. I think all the evidence we have to date in the many studies that have been conducted is that the ratio is very heavily in favor of the defense.

Mr. Livingston. Looking back over the last ten years at how hard the Soviets try to keep from going to the negotiating table on arms control and how they used the "peaceniks" of Europe to keep us from deploying SDI, it seems to me that it is all a very clear signal that an effective, relatively inexpensive deployment of a strategic defense system could make it absolutely economically prohbitive for the Soviets to continue to upscale their strategic weapon systems. So I again want to say how exicited I am about the program.

BRILLIANT PEBBLES

Brilliant Pebbles places many more objects into space than does the baseline Phase 1 system approved by the Defense Acquisition Board. Would this drastically increase the operation and maintenance and, therefore, the lifecycle costs of the Phase I system in order to monitor the health and position of many more objects than the baseline system? For the record, provide the lifecycle cost estimates for each approach.

General Monahan. I would be happy to provide more detailed estimates. I don't believe it would have much impact on the O&S costs. Each Pebble knows where it is at all times and has a star tracker on board. It knows where it is and where it is going and it is constantly reporting that information back to our computer so we don't have a difficult tracking problem with the Pebbles. As they move through the radar fences that exist in our space tracking system, our space tracking system is going to see them and if it notes that they are out of position or thinks they might be then they have to do a correlation. But the most that might come out of that would be some enhancement of the space tracking radars so they could handle more objects, but handling the objects themselves is not that difficult.

[Clerk's note.—The Department was unable to provide a response in time to be printed in this hearing volume.]

Mr. Livingston. I have other questions for the record.

[Clerk's note. Questions submitted by Mr. Livingston and the answers thereto follow:]

Question. The "Brilliant Pebbles" concept consists of a lightweight, low-cost, single hit-to-kill vehicle that provides integrated sensors, guidance, control, and battle management.

General Monahan, please take a moment to describe the technical features of "brilliant pebbles" and how it works.

Answer. Brilliant Pebbles interceptors are designed to orbit the earth in a constellation of dispersed, individual interceptors, called singlets, each with its own imaging and computing systems, propulsion, station-keeping, and communications. The Brilliant Pebbles concept employs kinetic energy as its method of inflicting lethal damage on its target—it contains no warhead, but rather destroys its target by the force of collision. Features of Brilliant Pebbles include:

Small size, including potentially, a total length of about one meter, a dry weight of less than ten pounds and a fully-fueled launch weight of about 100 pounds, thus requiring minimal space launch capability to deploy.

High capability/flexibility, deriving from pervasive use of existing or emerging commercial and military technologies. These include a set of minaturized, high-resolution, wide-field-of-view imaging systems working in multispectral bands; a CRAY-1 supercomputer class data processing unit; and a light-weight propulsion system.

Autonomous operability after weapon release authority by the human-in-the-loop. High performance imaging and computing systems, which would allow the interceptor to detect, identify, develop a high-precision estimate of position and velocity (track), and perform interception of targets after release commands.

Survivability, deriving from small size, autonomous capability, dispersal as singlets, low detection cross-section, jam resistance and low value per individual target. Survivability against a range of threats has been emphasized in the design of Brilliant Pebbles. Hardness against nuclear attacks is designed into the interceptor and is further enhanced by the interceptor's maneuvering capability.

The Brilliant Pebbles navigation system is based on a real-time stellar naviation module, a standard miniature angular rate-sensing and linear accelerometers, backed by a high-precision clock. Each interceptor always has a highly accurate knowledge of its location and heading, simplifying interception capabilities. The restartable propulsion system can be used to maintain any specified trajectory to whatever accuracy is required. Even if Brilliant Pebbles are flown at low altitudes, the station-keeping requirements permit them to fly such orbits for a decade before using an unacceptable fraction of on-board propellant.

Each Brilliant Pebble would be launched with a "life jacket" to provide solar-derived electric power through a rechargeable battery, as well as thermal environment control. This life jacket would be discarded after the Brilliant Pebble has been ordered by a human in control to an intercept.

Question. Explain how "Brilliant Pebbles" fit into the Phase I plan?

Answer. The Phase I system consists of both ground and space-based interceptors and sensors with their supporting systems. Brilliant Pebbles is the space-based weapon element.

Question. Explain your strategy of continuing work on alternative concepts to "brilliant pebbles" as a hedge against its failure. Can you really afford to do both? Do you plan separate, costly flight tests for each?

Answer. Alternative components are being pursued as part of the Brilliant Pebble and Space-based Interceptor programs. There is no duplication of effort. Funding for the Space-based interceptor technology program is currently planned for fiscal year 1990, 1991, and 1992. The Brilliant Pebbles program is making maximum use of the technologies developed under the Space-based Interceptor Program. There are no planned flight tests for Space-based Interceptor, whereas Brilliant Pebbles will be tested in at least ten experiments over the next two to three years.

Question. How many "Brilliant Pebbles" vehicles would be required to be "on-orbit"?

Answer. The number of Brilliant Pebbles required to be on-orbit to achieve the space-based portion of the effectiveness required by the Joint Chiefs of Staff is approximate ——— interceptors. Additional Brilliant Pebbles will be placed on orbit as replacement quantities.

Question. Describe the design strategy. Is the Los Alamos lab (its inventor) designing the vehicle, or will industry be free to bid alternative designs based on the Los Alamos concept?

Answer. The Lawrence Livermore National Laboratory (LLNL) design is considered to be the baseline concept. Industry will be free and encouraged to innovate, using the LLNL concept as a point of departure. Alternative system approaches which can demonstrate lower life cycle cost with at least equal effectiveness will be sought. Industry will focus on solving the challenges of miniaturization, integration, and system producibility.

Question. Which components of the "Brilliant Pebbles" vehicles are truly "off-the-shelf" today, and which ones require extensive technology development?

Answer. The current baseline design of the Brilliant Pebbles (BP) is comprised of "off-the-shelf" technology with no subsystems requiring extensive technology development. This is a result of one of the basic philosophies which guides the development of the BP: make it "simple and cheap". As a result, there is an inherent desire for "off-the-shelf" technology; however, technology which is not currently "off-the-shelf" will be incorporated into the BP design if it can be shown to make the BP simpler and cheaper while maintaining schedule and performance.

While it is true that none of the subsystems for the current design require extensive technology development, some are more mature than others. The following is a characterization of the current status of each BP Subsystem.

Subsystems for which technology is ready to go "as is": Ultra-Violet/Visible Camera, Avionics, and Thermal Management.

Subsystems which are in the qualifying testing stage: Inertial Measurement Unit, Interceptor Power, Propulsion, Survivability, and the Radio Frequency Communication.

Subsystems which require repackaging of the technology but whose designs are complete: Short-Wavelength/Medium Wavelength Infrared Camera, Star Tracker, Computer, Laser Communication Receiver, and the ———.

Subsystems which are brass broaded: ——— and the On-Orbit Life Jacket Power.

Subsystems which require redesign with existing components: Low-Rate Attitude Control System.

Subsystems which must be created from existing technology: None.

Subsystems which require advanced technology development: None.

Question. What is the acquisition strategy and key milestones?

Answer. The Brilliant Pebbles acquisition strategy consists of four phases: Concept Definition (CD), Pre-Full Scale Development (PRE-FSD), Full Scale Development (FSD), and Production.

The eight month long CD phase of the BP acquisition strategy will be conducted as a full and open competition of industry. The goal of this phase is to stimulate industry to be innovative in their design and manufacturing applications. Four to six teams will be selected for this phase.

The 30 month long Pre-FSD phase includes the development and test of hardware for evaluation before making an FSD decision. The two most successful designs submitted during the CD phase will be taken through Pre-FSD. The flexibility exists to incorporate attractive elements of unsuccessful designs into this phase.

The FSD phase, which is expected to be approximately four years long, is intended to develop the best design from the Pre-FSD phase into full scale systems. Both Pre-FSD teams will work to mature a single design.

The production phase will award two production contracts for the final production design.

The Key Acquisition Milestones for the BP program are as follows. ———.

Question. Is your "Brilliant Pebbles" acquisition strategy considered to be technology limited or funding limited?

Answer. The Brilliant Pebbles program is an innovative acquisition program conducted on an accelerated testing schedule. It is a balanced program designed to mature required technologies in a timely manner by effectively using available funding. As the President has directed, the Brilliant Pebbles program has been structured to be technology—and not funding—limited.

Question. How much "risk" is inherent in "Brilliant Pebbles"?

Answer. Inherent risk is a weapon system. Research and Development program is a function of the design, testing, production, and management of the weapon system. Careful design, comprehensive testing, early production and manufacturing engineering, coupled with management decisions based on assessments of risk in these areas leads to a low risk program. To address the issue of risk in the Brilliant Pebbles (BP) program, we consider the state-of-the-art of the scientific, technological and manufacturing base available to support the realization of the promise of the BP system as a small satellite. Satellites as well as missile systems include much near-term technology that is available to Brilliant Pebbles.

Based upon these criteria the Brilliant Pebbles (BP) has moderate inherent risk. Risk mitigation is being accomplished through a number of means. First the design is guided by the philosophy of making maximum use of off-the-shelf technology. The baseline BP design, which requires no advanced technology development, will be augmented by the Concept Definition contractors designs in the near future, further reducing already moderate technical risk. In addition, the Concept Definition contractors will focus their efforts on the production and manufacturing of the BP design. This early emphasis on production and manufacturing will reduce risk in an area that plagues many weapon system development programs. Second, the BP Program also has a comprehensive testing program in place, comprised of ground and flight tests which are designed to examine all critical technical issues related to the BP. All of these efforts coupled with the streamlined management of the SDIO BP Task Force will lead to a reduced risk program.

Question. Discuss the need for a long-wave infrared sensor in the "Brilliant Pebbles" vehicle, and the technology challenges involved?

Answer. The current Brilliant Pebble mission requires interception of missiles in their boost and post-boost phases of their trajectory. For this mission, the Brilliant Pebble does not require the use of a Long-Wavelength Infrared sensor. However, an expanded mission for the Brilliant Pebbles could benefit from a Long-Wavelength Infrared sensor.

Several alternative technologies exist for incorporating Long Wavelength Infrared sensors into Brilliant Pebbles. The Technology Office at the Strategic Defense Initiative Organization (SDIO) is conducting research on alternative focal plane materials. The long-term applicability of Long-Wavelength Infrared sensors for Brilliant Pebbles will be dependent upon, among other factors, the producibility and cost of these sensors.

[CLERK'S NOTE.—End of questions submitted by Mr. Livingston.]

COUNTERMEASURES

Mr. LIVINGSTON. Last year you testified that since Brilliant Pebbles is still in the conceptual and design stage, a set of countermeasures had not been defined. A study of potential countermeasures against Brilliant Pebbles, you said then, is expected later this year. What were the results of your study?

General MONAHAN. We conducted that study as part of the space-based architecture study last summer and fall, and looked at a number of possible countermeasures to Brilliant Pebbles.

The Red Team is a group from outside of our organization. We want them to really challenges and stress what it is that we are doing.

They looked at a wide variety of possible countermeasures, ———. We thought there were three that would be the most stressing against a Brilliant Pebble. ———. We didn't find any of those so stressing that they really would deal a large blow to Brilliant Pebbles' effectiveness. The simplest and most effective counter/countermeasure to those was to add more Brilliant Pebbles.

When you do so, the Pebbles themselves are relatively cheap compared to the countermeasure.

We have ratios of 10 and 20 to 1 as far as cost-ratio of the counter/countermeasures against those countermeasures. ———.

Mr. LIVINGSTON. It would have to get into the same orbit of each Pebble and stay there?

General MONAHAN. ———.

Mr. LIVINGSTON. You can't just come up on the side. ———?

General MONAHAN. That is right.

Mr. LIVINGSTON. ———?

General MONAHAN. The space mine concept we looked at. The space mine would not be simple or cheap. ———.

Mr. LIVINGSTON. I take it that is the type of rationale that leads to the story that I read a while ago into the record that reflects that the Soviets would have to spend ten times the initial cost of the system in order to catch up with it.

General **Monahan**. Yes.

Mr. **Livingston**. Last fall, there was a review of Brilliant Pebbles by the JASON group of scientists and they stated on the issues of countermeasures:

> Anyone can invest in countermeasures, but answering the question of which ones really work must, in most cases, await detailed studies and engineering development; those which are effective may be too costly, and there may be effective countermeasures. Only a full red/blue team study with the best available people on both sides can really address these crucial issues, buth there are some countermeasure concepts which we recommend for further study.

Which specific countermeasures did the JASON group tell you required further study, and what is the status of their recommendations?

General **Monahan**. One of the first things we did when we got the recommendation was to read it thoroughly. We have activity underway already. We had already looked at a number of those countermeasures and are continuing to do so. We anticipate we will go into full-scale development with Brilliant Pebbles in the 1993 time frame. Between now and then we will have constant Red/Blue Team countermeasure efforts going on. The JASON talked about things such as shrouded postboost vehicles, Brilliant reentry vehicles, and spacemines. We already were examining those in our Red/Blue Team effort. It was good advice that we got from them, no question about it.

COUNTERMEASURES FUNDING

Mr. **Livingston**. How much is budgeted in fiscal year 1991 in SDI for countermeasures work?

Do you feel that amount is adequate and how would the funds be used?

General **Monahan**. First of all, we do some direct countermeasures work as far as funding our Red/Blue Team efforts and are looking at survivability efforts, experiments, et cetera.

The dollars associated with those direct funds are about $22 million, I believe, for next year. But the majority of the funds that are spent studying countermeasures are within the various elements themselves; in other words, a lot of the dollars for Brilliant Pebbles will be spent on things such as decoys, and radiation hardening.

We are going to harden it to ten calories per square centimeter. Those types of efforts make it very difficult to break out within the various elements themselves as to how much is going into countermeasures.

Mr. **Livingston**. You do feel that the amount of money we are spending is adequate?

General **Monahan**. Yes, indeed.

INDEPENDENT "RED TEAM"

Mr. **Livingston**. There was some discussion in this committee in the last few weeks about the possibility of taking the Red Team out and putting it under the auspices of DARPA.

DARPA didn't necessarily advocate that, but the thought would be that since your Red Team is under the same house, that maybe you wouldn't get the full measure of evaluation that you might if you had a totally independent group making the evaluation.

General **Monahan**. We get the same evaluation the way we are doing it today as we would under DARPA. It could be done under another organization although I don't think it would be any different from what it is today.

Mr. **Livingston**. I will yield back to the Chair.

Mr. **Murtha**. Mr. Dicks?

LIMITED PROTECTION SYSTEM

Mr. **Dicks**. Thank you. General Monahan, nice to see you here. One of the major questions that has come up as we look at the changing world threat is this question of Third World issues. If deployed, SDI might offer some protection against a small ICBM attack from a Third World nation. What plan does SDI have to permit a limited protection system for accidental or deliberate launch from a Third World nation?

General **Monahan**. The review that was just accomplished by Ambassador Cooper, for Mr. Cheney, recommended that a formal study be done of a limited protection system.

Mr. **Dicks**. Which group was this again?

General **Monahan**. This was the study recently conducted by Ambassador Henry Cooper in response to a requirement in the President's directive of last year asking Mr. Cheney to take an independent look at the program to see if the priorities were set so that they would be in accordance with the President's directive, the NSD-14.

It is this directive that stated the President wanted to make a decision within four years to press on after Brilliant Pebbles, maintain layered defenses, and stay within the treaty. Coming out of that review briefed to Mr. Cheney a week ago, one of the recommendations was that the Department should undertake a study to get at the question that you just asked about. I think it is a very, very important question and I am glad to see that the Department is going to do so. The OSD International Security Policy staff will be in charge of doing that study. Having said that, the element that would make up a limited system are very similar to the elements that would make up the first phase of a Strategic Defense System as we have laid it out today. You would probably have less Pebbles or less ground-based interceptors.

Mr. **Dicks**. On that point, if we wanted to do this in a treaty-compliant way, we still have the right, don't we, under the ABM agreement to deploy 100 interceptors?

General **Monahan**. Yes.

Mr. **Dicks**. They would have to be ground-based radars as well?

General **Monahan**. Yes.

Mr. **Dicks**. In order to be treaty-compliant—we still have that option?

General Monahan. Yes.

Mr. **Dicks**. Some have suggested that that might be the kind of launch protection system, a very limited capability.

Is that a possibility?

General **Monahan**. Yes. Let me explore that with you a little bit. Here is why I am so gald to see they are going to look at this in some detail in the DOD. We have to ask what kind of threat are we worried about? Are we worried about launch of one SS–18, a boatload of SSN-23s, or a Third World launch? If, for example, a regiment of SS–18s, that might be deployed in one of the Soviet republics, has about 10 SS–18s, now you are talking about 100 reentry vehicles. Cut the number lower than that, to 50 reentry vehicles that you would have to worry about if it were just 5 SS–18s launched, then you have to worry about the density, where is that attack going, what part of the country? Is it going to the East Coast, the West Coast? Is it going to the Midwest? Then you would have to have sufficient density of ground-based interceptors near there such that you could intercept at that particular point.

Mr. **Dicks**. On that issue, I understood that Grand Forks, 100 inteceptors would give us a nationwide footprint of protection.

So in other words, no matter where the incoming RVs were coming—there was some question about this until the Soviets moved their SLBMs off the Coast, but with their current pattern, could the 100 interceptors give protection to the entire country?

General **Monahan**. No, it can't quite get the entire coastline. One hundred interceptors at one base is permitted under the treaty.

By the way, there is an argument though that those interceptors must not be made on "other physical principles" from the 1972 time frame.

Mr. **Murtha**. HEDI and ERIS——

General **Monahan**. They may not be because they are not nuclear-tipped. They are based on another physical principle; that is, kinetic energy intercept rather than on nuclear explosive intercept or nuclear warhead intercept.

Mr. **Murtha**. Clearify on what Mr. Dicks was asking—you said no, 100 wouldn't provide complete coverage?

Mr. **Dicks**. It depends on what technology.

General **Monahan**. Let me tell you—one base with 100 ground-based interceptors that are based on "other physical principles.'

You have to look in the treaty, and what "other physical principles" in the treaty means is something different from the interceptors contemplated at that time. The Soviets say those are the nuclear-tipped interceptors. The people on our Treaty Compliance Review Group are backwards and forwards on it. They don't know if there is a clearcut answer as to whether or not the kinetic interceptors like ERIS would be complaint.

Mr. **Dicks**. Say we have a right to do it. If we said to the Soviets this is what we are going to do and we are not going to go to a nationwide system Brilliant Pebbles and violate the ABM agreement, we are going to use coventional rather than strategic, there might be a way to work that out with the Soviets.

They have a system around Moscow—is theirs nuclear-tipped?

General **Monahan**. Yes, it is.

Mr. **Dicks**. But let's say that that could be handled. The HEDI and the ERIS are two systems that could be used as part of a limited system. Is that correct?

General **Monahan**. Yes.

RAND STUDY OF LPS

Mr. DICKS. I understand that in 1989, Rand did an analysis of the limited protection system. What were the Rand findings concerning ERIS under the ABM Treaty?

General MONAHAN. If you upgraded the PAVEPAWS and PARCS radars we have at the present time, the PARCS is at Grand Forks. The PAVEPAWS is on the periphery, four of them today. If we added a PARCS radar in the National Capital region, you could have limited capability. But they worried that it would be rather easily saturated. I forget exactly what the capability is to handle RVs, but they didn't think the PARCS and PAVEPAWS were adequate to do that kind of a job. What has to be examined is what kind of a threat are we worried about?

THIRD WORLD THREAT

Mr. DICKS. But clearly the President, his staff, and Mr. Scrowcroft, must be concerned about this Third World scenario as some of us are?

General MONAHAN. Yes.

Mr. DICKS. I was concerned about the idea of what happens in the Soviet Union—the idea of the Soviet Union unraveling and how they control their weapon systems. It is true that they probably have a better control over their entire force today in terms of permissive action links than we do. We allow some discretion, especially with our submarine commanders, they control it from a central system. The idea of something happening accidentally is rather remote, so we focus in on a Third World scenario, which isn't so remote. Qadhafi said if I had had a missile that I could have targetted New York with during the attack on my country, I might well have used it or threatened to use it to try to back the United States off, so this scenario can't be taken as a fantasy. There the question is frankly, General, I think your program is going to be a research program for a long time. I don't see us moving down the direction of deploying something.

I know that is not what you want to hear, but that is my judgment. The question then is if that is true and with the President's interest in doing something, then I think this notion of a limited protection system against a Third World scenario using the ground-based interceptors and radars could be something that the Congress might agree to do because there is this concern about this so-called Third World threat and the fact that we don't have any capability whatsoever now.

Mr. LIVINGSTON. Would the gentleman yield?

Mr. DICKS. This is not going to be very satisfactory, but it would be at least some protection and it is affordable. I have been told that some system like this would only cost us two or three billion dollars. Is that low for that kind of a system?

General MONAHAN. That would be very, very low.

Mr. DICKS. For a hundred interceptors, what do you think we are talking about——

General MONAHAN. I really have not worked that problem of just what such a system would look like.

Mr. DICKS. Shouldn't we be working that? The President's people are saying——

General MONAHAN. The reasons you bring up, I think are an excellent idea. The DOD is going to study the problem and study it hard. It will be under the direction of the Under Secretary of Defense for Policy, Ambassador Wolfowitz, and they will have a tremendous amount of support from our staff. I think the limited protection system makes a lot of sense.

I think we need to worry about how much of the country are we going to protect. Do we want to protect the entire United States, including Alaska, Hawaii and Puerto Rico? That makes the problem a little bit different and starts to size the problem a little bit.

Then how much of a Third World threat are you going to worry about? How many missiles coming from some place do you want to worry about at one time? Those are factors that will make a difference in sizing the system.

Mr. LIVINGSTON. Would the gentleman yield?

Mr. DICKS. Of course.

Mr. LIVINGSTON. I am curious, given the fact that Qadhafi did make a statement the other day to the effect that if he had had missiles or a nuclear warhead available to him, he would have dropped them on New York during the 1986 confrontation, and given the fact that ERIS and HEDI might intercept an ICBM at the intermediate stage, but have no chance of hitting it in the boost stage or the bus stage, which means they are almost guaranteed to miss some re-entry vehicles and that major portions of our country are going to be annilated. Why wouldn't we seriously consider the deployment of a cheap, low-cost Strategic Defense System which will cost the Soviets some seven-to-ten times what we spent on that system to counter it?

Mr. DICKS. Obviously, I am exploring one facet of this thing. I have said very clearly here I think there is a major affordability problem of going with a comprehensive system like Brilliant Pebbles. I do think that the case has been made that there is a Third World scenario that needs to be dealt with.

What I am trying to explore with the General is how much we would get out of a HEDI/ERIS system and what the limitations are so we will have a good understanding of that possibility.

Mr. LIVINGSTON. I think it is a good question if the gentleman would yield further. I think the real question is do we want to take a chance on the possibility of the annilation of a massive number of our people for the sake of cost, for the sake of budget? I think the answer to that question is no. I think the American people will say clearly no.

Mr. DICKS. Since the President of the United States has commissioned a very important study on it, clearly the White House understands affordability problems. I think as we get to marking up this bill and the next one and the one after that, we are going to have a better understanding of what is affordable and what isn't. I think this remains an alternative that has to be explored. That is all I am trying to do today.

Mr. MURTHA. Mr. McDade.

MEMBER VISITS TO SDI FACILITIES

Mr. McDADE. I want to yield my time to Bob Livingston.

Mr. LIVINGSTON. Mr. McDade, this is a massive subject. We can spend an hour, we can spend a day, we can spend two weeks on this issue and we can complete the record to the extent that you all think it is necessary.

It is an incredibly interesting subject, so I have no hesitation to go on and on.

Mr. McDADE. As the person designated on our side you have done a great job doing all you are doing. I would rather yield my time to you.

Mr. LIVINGSTON. I want to make sure we have time for Mr. AuCoin when he is ready because he has some great points and I think they need to be answered.

Mr. McDADE. I yield to Mr. AuCoin.

Mr. MURTHA. Mr. AuCoin.

Mr. AUCOIN. Well, Mr. Chairman, I really didn't have any other conflict. I just wanted to stage this kind of an entrance. Mr. Chairman, I apologize for being late. Tip O'Neill said all politics is local. I had a hearing in which I had to testify on behalf of a local Oregon program in Mr. Natcher's committee, and I appreciate you understanding that I couldn't be here exactly on time.

General Monahan, it is good to see you. I want to indicate to you, Mr. Chairman, and to my colleagues, and I think Bob Livingston would echo this and probably has already expressed it, that when Mr. Livingston and I made our trips to look at the various places where SDI work is being done, we dealt with uniformed people as well as SDI personnel, including the top flight people in the organization. We could not have been given more cooperation, Mr. Chairman. The record really should reflect that. In particular, the chief scientist, Dean Judd, was extremely helpful to us. He is here today. I want to state for the record that I think he is a top-flight professional and always eager to entertain a question, a challenge, and equally eager to engage in a spirited intellectual exchange. I think that reflects great credit on SDIO, and my esteem has increased as a result of that for the personnel—not necessarily for the program, but for the personnel.

Mr. LIVINGSTON. Would the gentleman yield? Let me just rephrase the questions I put earlier. In essence, we had a re-cap from General Monahan about Brilliant Pebbles and certain aspects about countermeasures and the like, and it has been pointed out that recent articles reflecting the Cooper Study and the JASON Study show that an effective, relatively inexpensive $55 billion SDI program would cost the Soviets in the nature of almost a trillion dollars to counter, and that the benefits are far greater than the cost to us and that an effective system, not necessarily the Cadillac of systems, would provide us with protection against incoming RVs and prevent mass annilation of our people.

The question then becomes—and I think this is one area to explore—what are the deficiencies of the program if deployed?

Are there any deficiencies? I think I agree with you. I concur in your statements. The SDIO folks have gone to extraordinary means to satisfy our questions and try to answer them. They have answered them in large part to my satisfaction, but I think I will toss it to you and let you see what you can do with it.

Mr. **MURTHA**. Let me add one thing. We just discussed briefly the possibility of a missile being fired by a Third World country and limited coverage which in line with the amount of money we have available for that type of a thing—we just started to really discuss that before you came in.

Mr. **AuCOIN**. Okay. Let me just add one other preliminary comment.

I want to express to you, Mr. Chairman, and also to Mr. McDade, that I certainly couldn't have had anyone travelling with me on these travels from the other side of the aisle who made a better contribution and was a better travelling companion in terms of trying to find facts and getting into things than Mr. Livingston.

ARMS CONTROL

I want him to know that and I want to state that for the record, as well. Before we get into those kinds of questions, General Monahan, there is a reference in your supporting documentation about arms control, and I believe you have a statement that you wanted to insert in the record to clarify the text of your supporting documentation which doesn't really reflect your thinking.

I would like to give you an opportunity to do so.

General **MONAHAN**. Thank you. I don't know that I have it immediately available, but you are referring to the descriptive summary that talked about our countermeasures. I will submit that for the record.

[CLERK'S NOTE.—The Department was unable to provide a response in time to be printed in this hearing volume.]

THIRD WORLD THREAT

Mr. **AuCOIN**. Mr. Chairman, on the question of a Third World Qadhafi-type of threat, my view of this is to try to think it through from the standpoint of the potential perpetrator.

If I were a Qadhafi or someone like him and wanted to drop a nuke in an American city, I would want to do that without shooting myself in the foot. The best way to accomplish the damage that I sought for the United States would not be to use a missile which would give away the source of the attack, but instead, to use a nuclear device, put it in a suitcase, smuggle it into the country or have it assembled in the country, put it in a locker in Grand Central Station, and have it blow up then. Who knows in that situation who the perpetrator was?

So it seems to me that in terms of a terrorist nuclear attack, that would be more plausible than a missile that gives away who it was that shot. Do you not agree that if you were in the shoes of the perpetrator, that would probably be a step that you would take?

General **MONAHAN**. If we think that such a threat is a reasonable possibility, then I think we need to be taking steps to deal with that. I don't think it is as simple as a suitcase. It has to be more sophisticated than that. It is not an easy thing to do to make it happen and all the sequence of events to go off, but I would concede perhaps that is a possibility, but a very difficult thing to do. If we think that it is a reasonable possibility, then some measures should be taken to defend ourselves against that. On the other hand, with the ballistic missile situation, what we are really worried about in the Third World is there are 20 countries estimated to have been able to have ballistic missile capability in the 21st Century, perhaps nuclear, it is a matter of time until that information is available.

For the past 40 years, the United States and the Soviet Union have deterred one another from nuclear war, but deterrence requires rational thought on both sides. We are more concerned about an irrational act on the part of some leader somewhere in the world. If we look at the Iran-Iraq war, national leaders willingly sacrified thousands upon thousands of their nations' youth for causes that I think you and I may consider to be irrational. A scenario in which a leader of that sort has the kind of capability he now has, the real capability for blackmail, if you will, he can just make the threat as Mr. Qadhafi did, and what are our options? We don't have any today except to go in perhaps and attempt to destroy his ballistic missile capability. I submit to you that that is not a good option. If one got loose, Mr. Qadhafi could say——

Mr. **Murtha**. You say that is not an option to go in and destroy?

General **Monahan**. It is an option, but I think it is a very difficult option for the President to have to select.

Mr. **AuCoin**. I hear what you are saying and I have heard those arguments before. I would have to indicate that if the Commander-in-Chief saw a capability developing and had information that suggested that there was the probability of use, I think he would be fully entitled to and I would be amazed if he didn't order a preemptive action. The Israelis did it in the case of the Six-Day War. I think we should do the same. And one thing that is different in this instance than in the case of the Iranians and the Iraqis is that all those youth that were killed by the thousands were pawns that were being played by the political leaders. In this kind of an instance if a Qadhafi launches a missile at the United States, it is not going to be a few pawns that are going to get the reprisals, he is going to get it himself and I think that is an important distinction.

General **Monahan**. One futher comment.

I think this is reasonable. Suppose Mr. Qadhafi did launch one and the first thing he said was it was an accident, I didn't mean to do that. You will never know one way of the other whether it was an accident or not. Suppose it lands on a major American city and kills a million people, which is a likely scenario. What response options does the United States have at that time?

Mr. **AuCoin**. The response would be to believe him and to let him get away with it or to not believe him and retaliate?

General **Monahan**. What kind of retaliation? That is a terrible option to be faced with.

Mr. **AuCoin**. The damage on the United States would be terrible——

Mr. **McDade**. It is an interesting discussion, but it seems to me that when we look back at the Israeli effort when they took out the nuclear reactor in Iraq years ago and did it with distinction, that's an option that probably isn't on the table anymore with Iraq maybe today possessing the nuclear, and the chemicals. The Iraqis have said if the Israelis come near their facilities, that Israel will burn, using the chemical or biological stuff, so that those options tend to get shriveled up.

If you are a Qadhafi with a lot of money and there is technology around the world, you don't want to do the suitcase, you will want to be able to say the Yankee devil will pay, you may incinerate me, but I will take many of your people with me.

Mr. Livingston. I might say that we already have causes for a preemptive strike on Qadhafi. He has been producing chemical weapons for the last two or three years, and we know his state of mind when he tells us on April 21, and I am reading from the NBC release—he said he was ready to drop the missiles on New York City in 1986 if he had them.

So he could just as easily have used those chemicals on us as well, and that state of mind and that capability is cause for a preemptive strike, in my opinion, yet we have not done one.

Mr. AuCoin. Mr. Chairman, I have a lot of questions I would like to ask.

Mr. Murtha. We are yielding our time to you.

COUNTERMEASURES

Mr. AuCoin. General, one of your researchers argues that a ———.

This goes directly at the cost effectiveness in terms of countersmeasures versus the Phase I SDI. This was a very impressive researcher who made this argument and I would like your response.

General Monahan. Okay. He is talking about cutting a hole in the Pebble constallation. A little earlier I talked about the Red/Blue Team efforts that we did on Brilliant Pebbles last summer, and that is continuing.

In there we looked at a whole series of possible stressing countermeasures and this was one of those. There are three countermeasures we paid most attention to ———.

That is a specific scenario that we looked at. He would be punching a temporary hole into the constellation. He has to know where the Pebbles are, they didn't give any credit for the Pebbles being able to move, any credit for the Pebbles to be able to launch decoys, which they clearly could do. It would take ——— and there are ways of filling in the hole.

We can acclerate other Pebbles into position, but more importantly, you can add more Pebbles. We can start to put them into retrograde orbits. There are many, many counter-countermeasures to this that were much easier than the countermeasure itself.

Mr. AuCoin. The argument made was that depending on the size of the blast, it would take out far more than just one Pebble, it would take out a large number of Pebbles and though it may not be permanent, it would be long enough for the launch of all the SS–18s. Compensating for that, according to my information, would mean that you have to build 20 Pebbles for each Soviet DANASAT.

General Monahan. In order to do that sort of thing, to take out more than one Pebbles, you are talking about megaton capable weapons in order to do——

Mr. AuCoin. That is correct.

General Monahan. I think it is doubtful you could get more than one because the Pebbles are 200 kilometers apart.

So the ability to neutralize more than one Pebble at a time, even with a megaton weapon seems to me unlikely. Nevertheless, you still have the opportunity to launch decoys and to maneuver and to fill in the hole. The other thing that you are left with, of course, is the Soviet Union would be exploding these megaton nuclear warheads over their own territory and now they have to launch through them.

One thing we worry about is trying to launch through a nuclear explosion. Nobody knows for sure what the effect of that is. So there are tremendous regrets on the Red side——

Mr. AuCoin. I think we plan to do that in a second strike retaliation, don't we? We plan to launch ICBMs if we are under attack.

General Monahan. Indeed, through the debris.

Mr. AuCoin. Which is exactly the effect——

General Monahan. We would never voluntarily have the nuclear weapons go off and try to fly through them. Nobody would ever voluntarily try to do that.

Mr. AuCoin. Actually, our response to attack would be a more stressful environment than the Soviets trying to launch their SS-18s through a DANASAT, you get debris at a low altitude.

General Monahan. They have to pass through that altitute, the Brilliant Pebbles, during their ascent. What does it do to EMP lines and all that?

There are certainly very many unknowns and a lot of severe regrets to the Red side for taking on that kind of countermeasure if he thought he could do it. I don't think he could do it.

Mr. Livingston. I think it would be important for the record to get a scientific appraisal on the Soviet Union if they exploded a weapon of that type.

Mr. AuCoin. We are talking an altitude of 400 kilometers up, so let's have it described from that standpoint.

General Monahan. The best evaluation you can get would probably come from Dr. Dean Judd. If it is permissible for Dr. Judd to discuss this because he has spent an awful lot of time on it. He is as expert as anybody in the nation.

Mr. McDade. I would ask you to state precisely what question he is going to answer at this juncture because we are kind of back and forth. That will be helpful to have that stated.

Dr. Judd. The threat against a space-based system using a one megaton nuclear ASAT exploding to try to take a lot of different assets has certainly been looked at extensively.

Mr. AuCoin. My point, and I think your researcher's point was not that it would necessarily take out all the Brilliant Pebbles, but disable enough of them to allow the SS-18 launch.

Dr. Judd. What we have found is that you couldn't take it out with one megaton in space nuclear ASAT.

They are just spaced far enough apart that with one explosion going off, even a megaton explosion, it would not take them all out or even a significant number. You would have to put many megaton explosions up there.

The problem people had was the question of the electro-magnetic pulse. You're exploding them over your own territory, and you're having to fly through them in a very accurate formation. While our systems are designed to fly out through a nuclear attack, it is not a thing that, as General Monahan pointed out, an offensive planner would like to do. It spoils the coordination of his attack, it puts uncertainties in there that wouldn't ordinarily be in there, things like that.

So after a lot of extensive Red Team analysis, most of the people that have advised us really say: yes, you could put a megaton in space nuclear ASAT over your own head and then try to fly through it. You would probably still have to try for one-on-one. You could still put 150 megatons off over your head, but they think that is not the approach that the Soviets would take.

Mr. **AuCoin**. Doctor, the researcher that spoke to us on this indicated that the kind of—that one megaton blast at the elevation of 400 kilometers would take out not the entire system, I never said that and neither did he—he was talking about punching a hole of something like 145 Brilliant Pebbles, not necessarily killing them all, but disabling that number of them which creates a hole through which the SS-18s could be launched.

I think you would agree that that is an environment that is full of debris but far less debris then we would have, that we are prepared to fly through with our ground-based ICBMs if we are attacked and have to mount a retaliation.

Dr. **Judd**. I understand, but the issue is can you take out more than one Pebble with just one megaton launched.

Mr. **AuCoin**. You indicate that at least 145 would be disabled if not taken out.

Dr. **Judd**. We don't have any studies that indicate that.

General Monahan. Another important factor is that even if you could do that, the results are temporary, the hole gets filled——

Mr. **AuCoin**. The launch is temporary.

General **Monahan**. The next thing that happens is he is then confronted with the ground-based layer. If he does find a way to get through the space-based layer of the system, then he is confronted with the ground-based layer in mid-course.

That is one reason for having layered systems, of course, its resiliency to countermeasures. He can go to all the trouble of trying to punch his way through that and create a temporary hole in a Brilliant Pebble constellation which I still doubt is very realistic, but then he still has not solved his problem, because now the ground-based layer is going to be there and ready to move.

Mr. **Livingston**. Would the gentleman yield?

I think we got confused.

Mr. **AuCoin**. I would yield this time, but I really want to get through my questions. I want to finish my questions and then the gentleman can ask his questions.

SDI SYSTEM OVERVIEW

Mr. **Livingston**. I will be happy to. I am just concerned that maybe we have missed the ability to explain the entire system, and sometimes the gentleman hits on some specific points that, frankly, I would like to comment on, and also to elicit additional questions——

Mr. AuCoin. He can do so on his time.

Mr. Livingston. I will withdraw that request, but I think that for purposes of the record at this point since we haven't done it, it would be important for someone, either General Monahan or Dr. Judd, to give us a quick five-minute overview of exactly what the system is.

Are we talking about ground-based systems? Are we talking about boost stages, about intermediate stages, and buses and reentry vehicles? If you could just give us a quick thumbnail sketch of the area, I think it would be helpful.

Mr. AuCoin. I want to be cooperative, Mr. Chairman, and I think that might be a good thing to do if the gentleman will use five minutes of his time to allow that.

Mr. Livingston. Nobody else is taking any time. It is just you and I.

Mr. AuCoin. It is 11:10. I came late, I realize, but there are a lot of questions.

Mr. Livingston. You did come late. I am trying to make sure that everybody and the record is perfectly clear about what we are talking about.

Mr. AuCoin. So let's have a five-minute explanation, then I will finish my questions and the gentleman can get his questions answered and we can conclude the hearing.

General Monahan. To assist in explaining that, we have some handouts we are going to leave with the Members at the end of the hearing.

If it is permissible, Mr. Chairman, I can refer to one or two pages. Look on page 6. Let me use that for a moment to help explain. What this depicts is the trajectory of a ballistic missile.

If you look at the bottom, we note that we attribute about a 30-minute time of flight to the ballistic missile, not on the missile, but until the warhead impact. At the right-hand side of the chart, we start with the launch and we divide the entire trajectory into four phases: the boost phase, post-boost phase, midcourse, and terminal. All the warheads are on board in the boost phase. During the post-boost phase, the warheads are being dropped off the bus. So you may or may not have all ten still on board during that phase. Both phases are relatively short. Then we get into the longer midcourse phase. Now, we have to worry about decoys, devices that look like reentry vehicles, but indeed are not. So we have to discriminate between them. In the terminal phase, the decoys are stripped out by the atmosphere. So we don't have to worry about the discrimination problem, but you have problems with atmospheric effects and a very short time to operate.

On page 8, I believe, this is all the further we will have to go, to explain the Phase I architecture to some extent. You see in the middle of the page the Brilliant Pebble. We have 4,000 deployed in the first phase. They would have the mission of intercepting in the boost and post-boost phase of the ballistic missile trajectory. On the left-hand side, you see ground-based interceptors. They would intercept in the late midcourse phase so then you have two layers to attack: the ground-based and space-based layer. There is a possibility also of an additional ground-based layer that would operate in the terminal phase within the atmosphere. We are studying that at the present time. The HEDI experimental vehicle is designed to address that particular problem.

We also are taking a look at giving capability to Brilliant Pebbles to operate in the midcourse. A different type of sensor would have to be added on in order to do that. So that explains the various components of the system.

[CLERKS' NOTE.—Classified charts removed.]

Mr. LIVINGSTON. Thank you, and thank you, Mr. AuCoin.

SPACE MINES

Mr. AUCOIN. General, at Sandia I saw some of your Red Team people working very hard and I think very sincerely to build decoys—this is your Red Team—to build decoys that could defeat SDI, but I haven't heard of anyone and didn't see any evidence that anyone is working on the space mine threat.

Do you have Red Team people actually trying to work that countermeasure problem?

General MONAHAN. The space mine threat, I believe, was worked—we have given a lot of thought to it in the past, and it was one of the items that was looked at in the Red/Blue Team effort that we did on Brilliant Pebbles last year. We will continue with that Red/Blue Team effort right up to the point of full-scale development of Brilliant Pebbles.

Mr. AUCOIN. Has anyone tried to actually make one?

General MONAHAN. I don't believe anyone has attempted to do that, no.

Mr. AUCOIN. Could you give us for the record a description of the working that you have done against the space mine counter threat potential?

General MONAHAN. I can tell you a few of the things we know regarding the space mine situation.

First of all, I think people have expectations, that space mine, because of its name, would be a relatively simple device, equated to a sea mine where a ship runs into it in the ocean.

That is not the case at all.

It wouldn't be simple or cheap.

[CLERK'S NOTE.—The Department was unable to provide a response in time to be printed in this hearing volume.]

Mr. AUCOIN. SDI wouldn't be cheap?

General MONAHAN. SDI would not be cheap, but the mine itself would be much more complicated than the Pebble.

It would have to be either directly ahead of or directly behind the Pebble, operating on exactly the same plane. ———. The Pebble has capability to launch decoys, and to maneuver; this device then would have to try to keep up with the Pebble. The Pebble, of course, with the decoys, could get out of the way and do all sorts of things. You could probably give some shootback capability should you want to do so. But the device itself is much more complicated than a pebble. With that kind of complication and the fact that we have 4,000 Pebbles up there, the Soviets would never know whether or not the mines could do the job, whether or not they could be in position, and they wouldn't know the kind of counter/countermeasures that would come about. We don't think that is one of the more stressing countermeasures. We think there are others more important than that.

NEUTRAL PARTICLE BEAM TECHNOLOGY

Mr. AuCoin. Would the decoys deceive a potential Soviet nuclear particle beam?

General Monahan. The neutral particle beam device will have to have sensors on board in order to do pointing and tracking so that the decoy would be there for the purpose of interfering with the pointing, tracking, and the acquisition of the sensor itself.

It probably could, yes.

Mr. AuCoin. A Soviet nuclear particle beam could discern a decoy as a decoy?

General Monahan. Yes.

We are talking about decoys of reentry vehicles, right? We think that is one of the methods that we are looking at to assist in discrimination.

Mr. AuCoin. The Soviets have capability, the decoys that you have indicated that would deceive the Soviets, if the Soviets develop a nuclear particle beam, they would have a discrimination capability to determine what is a decoy and what is a Brilliant Pebble, wouldn't they?

General Monahan. First of all, I can't imagine somebody using a neutral particle beam in order to try to find a Brilliant Pebble. It would be very much of a waste. By the time neutral particle beam weapons could be deployed, I think they would probably be replacing the Pebbles to begin with.

They would be much more effective. It is a much later generation technology and one in which we are very, very far ahead of the Soviets.

Mr. AuCoin. Is it that far away? Is the technology just for discrimination purposes as opposed to weapons purposes?

General Monahan. For discrimination purposes, you probably don't need the same power levels, but you still have to do pointing and tracking.

Mr. AuCoin. Is that pretty much the consensus of the scientific community, that a neutral particle beam for simply discrimination purposes is about as difficult a task to develop as a neutral particle beam for weapons purposes?

General Monahan. No, I don't believe so.

I think you can do it at much lower power levels and I don't believe you would need the same kind of pointing and tracking accuracy. If we had to do it, if we wanted to accelerate it, it is a matter of financial constraint more than anything else.

Mr. AuCoin. That would seem to argue that a Soviet capability with a neutral particle beam for discrimination purposes would be an effective way to determine what is a Brilliant Pebble decoy?

General Monahan. Sure, but I am talking about putting a lot of decoys up there and you are talking about something that is there to decoy the sensor, interfere with the sensor that is on board the mine itself.

Mr. **AuCoin**. I was impressed in the briefing on the neutral particle beam about how quickly it moves to look again, zap, zap, fractions of a second.

General **Monahan**. Yes. You are talking now about the 20-minute period of the midcourse phase. The neutral particle beam can discriminate between decoys and RVs and say this object which is traveling in a certain trajectory with a certain brightness level, that is a decoy and that is an RV and pass that on to interceptors and say, "Go after this one rather than that one." The interceptors come from several thousand kilometers and there is a lot of time that goes by: You are talking about a situation where a Pebble thinking it was about to be attacked could launch a decoy very quickly. Whether or not the neutral particle beams would be looking at all 4,000 or whatever number of those Pebbles at one time and be doing that, I would rather they use neutral particle beams for that than for knocking down our RVs.

Mr. **AuCoin**. That would be in the fly-out corridor?

General **Monahan**. That is the case with the ones we are looking at with RVs. You have a large device, and the decoys themselves will be relatively large.

You are talking about a very small Pebble along the lines of something like a flare. A flare would be effective. It doesn't have to burn for very long for the Pebble to get out of the way and make the spacemine home in on the wrong thing. This is like the flare that we use to defeat air-to-air missiles today. I think the problem there is a different decoy problem from the one to decoy RVs.

Mr. **AuCoin**. The Pebbles are designed to move and the decoys aren't, so the Pebbles are going to have to get out of the way.

General **Monahan**. You can give movement to the decoys or you can leave the decoy here and the Pebble can move out of the way.

SHAPED CHARGE SPACE MINE

Mr. **AuCoin**. Let me move on to a particular kind of space mine. At Las Alamos, I had a long conversation with Dr. Canavan, who works with Dr. Teller, about space mines using shape charges like we now use on anti-tank weapons.

All I wanted to ask you here is will you look—Dr. Canavan has a very high reputation. He regarded this as a very significant potential for a space mine countermeasure and I would like you to assure the committee that your shop will look into this potential countermeasure very vigorously and keep the committee posted on what you are doing on that at regular intervals.

General **Monahan**. I will be very happy to. Any countermeasure that people can bring to the table, we look at.

That is one of the duties of the Red Team to do that. So we will do so.

NUCLEAR DEBRIS

Mr. **AuCoin**. Brilliant Pebbles has a very severe potential problem with nuclear debris emitting gamma rays. We spoke of this personally recently, and we were briefed on this, Dr. Judd was with me when we were. I understand you are looking into this, and you indicated that you would look further into it when we spoke yesterday. Will you keep the committee posted on your investigations on that as well?

General **Monahan**. Yes, indeed.

SOVIET BRILLIANT PEBBLES

Mr. **AuCoin**. I would like to just turn to Soviet Brilliant Pebbles against ground-based systems, because I think we have to keep in mind that if we decide to develop a technology, then we, ipso facto, cannot enter into any kind of arms control arrangement that would deny the other side the opportunity to go to the same kind of technology. So it is possible for the Soviets to develop Brilliant Pebbles themselves and we have to take that into account, I think, as we judge the whole SDI program, so that it is not just a capability we would acquire, but a capability we would some day be permitting the Soviets to acquire just as in the case of MIRVED missiles.

How are you going to protect the Ground-Based Surveillance tracking system and ERIS from a Soviet Brilliant Pebbles system? Couldn't a Soviet Brilliant Pebbles system zap both of those in the boost phase?

General **Monahan**. A Soviet Brilliant Pebbles system, if it had the equivalent capability to ours, could intercept just about anything that is boosted.

Mr. **AuCoin**. So they could not be protected——

General **Monahan**. I don't think they could. That is one thing.

The other thing is if the Soviets deploy a Brilliant Pebbles system, and if we start doing that, then we are probably starting to achieve our objectives.

One of our objectives is to lead to a defense-dominated world, to get to the point where offensive nuclear weapons become less and less effective. So if the Soviets and we both start heading in that direction, that is exactly the direction that the President would like to go.

Mr. **AuCoin**. That would be good if we could trust the Soviets to use their "defense" always in a defensive mode, but these defensive systems are weapon systems and do have an inherent offensive capability.

I remember General Vessey testifying before this committee at the beginning of the wrap up of Defense spending. He stated that as a soldier he had to always judge his adversary on the basis of their capability.

There is an inherent offensive capability in this SDI, whether ours or theirs.

General **Monahan**. There is nothing against anything on the ground or anything in the atmosphere.

Mr. **AuCoin**. You could use Brilliant Pebbles, the Soviets could develop a Brilliant Pebbles system and use it as a defense suppressor.

General **Monahan**. It will operate against anything that is launched outside the atmosphere.

Mr. **AuCoin**. The scenario I just gave you——

General **Monahan**. Anything that is launched and goes outside the atmosphere, Brilliant Pebbles should be able to intercept.

ABM TREATY COMPLIANCE

Mr. AuCoin. Under your current plan, what would be your first—under the schedule and the plan that you are moving forward on, what would be your first non-treaty compliant act?

When would that occur?

General Monahan. I am not planning any non-treaty compliance act.

Mr. AuCoin. If the program goes forward, at what point do we reach that?

General Monahan. It will be some time in the full scale development phase of Brilliant Pebbles that we would run up against a broad versus a narrow interpretation of the treaty, 1994-95. Now, that may or may not be treaty compliant depending upon whether or not one believes in a broad interpretation or a more restricted interpretation of the treaty.

Mr. AuCoin. If it were the narrow interpretation, what would be the threshold?

General Monahan. 1994 or 1995.

Mr. AuCoin. The act?

General Monahan. We would finally have to do some testing that would violate a restrictive interpretation of the treaty. We would start doing testing in a more operational mode, in a ABM mode, as they say, and that is what would do it. In the meantime, all of the tests for 1991 and the whole Brilliant Pebbles test scheme leading up to full scale development, is designed to be compliant with the restrictive interpretation of the treaty. The first thing that clearly violates the Treaty would be deployment of the Brilliant Pebbles. That is about the 1997 time frame.

Mr. AuCoin. But your testimony is that a testing would be—would it be a non-compliant act?

General Monahan. No, I did not say that, under a restrictive interpretion.

Mr. AuCoin. As the program is moving forward, which of the programs would likely be tested first based on the momentum behind them?

Would it be ERIS, Brilliant Pebbles or something else?

General Monahan. First of all, ERIS and Brilliant Pebbles both are on somewhat similar time tables. We plan for our first Brilliant Pebbles test launch late in May of this year and we plan for the first ERIS flight just a couple months thereafter.

ERIS, of course, is just an experimental prototype if you will, of a possible ground-based interpretor, and that schedule lags behind the Brilliant Pebbles, the space-based interceptor by a period of about two years.

NEUTRAL PARTICLE BEAM

Mr. AuCoin. Let me move to the neutral particle beam and its survivability. I don't think anyone could help but be impressed by the potential of the neutral partical beam as a discriminator.

We certainly had a good briefing on that. But I am also impressed by it as a very fat target that could cost—I think the cost could be up to a billion dollars a piece. How do you protect an orbiting beam generator from a space mine, let's say?

General **Monahan**. Well, again, there are a number of measures that one can take against a space mine. You would use decoys. You could use something that shoots back. In other words, something to shoot off the particle beam itself and a kinetic energy weapon would probably be the most effective way to do it or you could use the particle beam.

Those are the ways that one would fight back.

Mr. **AuCoin**. Use the particle beam to shoot first?

General **Monahan**. Yes, if you wanted to do so.

Mr. **AuCoin**. So defense depends on a shoot first——

General **Monahan**. I didn't say that at all. I said that you could shoot with a kinetic energy weapon, you could launch decoys, do all these kinds of things.

Mr. **AuCoin**. The mine will already have done its damage——

General **Monahan**. If there is a shoot first situation, you will have to put up with that. In any kind of a duel, whoever shoots first wins. He would have to shoot first around the world, that would be an indication to us that something was up.

Mr. **AuCoin**. That is a significant policy question as to whether we should shoot first at an object that hasn't shot against us.

Leaving aside shoot first, how would you protect an orbiting——

General **Monahan**. I think with large satellites, such as a neutral particle beam weapon, there would have to be some sort of "keep" out zone policy established, some rules of engagement with the other side on those kinds of things.

KEEP-OUT ZONES

Mr. **AuCoin**. What if the Soviets decide they don't want to agree to a keep out zone?

General **Monahan**. Then in that case, anything that goes in the keep out zone we would have to shoot down.

Mr. **AuCoin**. So it would be a shoot first situation?

General **Monahan**. It is a warning first situation. We have guarded areas all around the world. We guard certain places on our bases today and anybody that enters is subject to being shot or whatever.

I think you would have the same sort of situation here.

Mr. **AuCoin**. The example you have just given are cases where people are coming on our property. A better example of what I am describing would be the high seas and Soviet ships that come up near our ships at sea because the seas are free, are not in and of themselves considered engaging in a hostile act and I don't think we shoot at surface ships.

Space is the same way.

General **Monahan**. What you are postulating is something that I think is incredibly unlikely, that is, that all Soviet space mines are going to shoot at exactly the same time at all United States satellites and shoot all United States satellites down at exactly the same time.

If we knew on the high seas that the Soviets had the capability of simultaneously destroying every United States ship by coming up close to them, I don't think we would let that happen. On the high seas, if they start shooting at one of our ships, it is not a certain death for the ship. Yours is a case of absolute certain death, which I don't think is realistic.

Mr. AuCoin. You have given me the answer. The answer is that if the Soviets were to place orbiting space mines, that we would have to declare some kind of "keep out" zone and if violated, we would have to shoot first?

General Monahan. If we assessed that there was a reasonable threat, a reasonable probability that all Soviet space mines would be activated and would attack simultaneously and destroy all of our satellites, then I think you would have to have a keep out zone policy.

If you attributed that kind of capability.

Mr. AuCoin. Mr. Chairman, I have a lot more questions, but I know Mr. Livingston has a lot of questions, too.

Mr. Murtha. Mr. McDade.

SOVIET BRILLIANT PEBBLES

Mr. McDade. What is your professional opinion as to the possibility for the Russians in the next 10 or 15 years producing a Brilliant Pebbles?

General Monahan. I think practically nil. I don't believe they would have that capability at all.

Mr. McDade. Do you agree with that, Dr. Judd?

Dr. Judd. Certainly we are pushing the state-of-the-art as fast as we can. We don't have any indication that the Soviets have nearly the miniaturization capability or computing capability that we have.

Mr. McDade. When you do the Red Team, you indicated that as you go through those exercises, there were a couple of things that you thought might be the countermeasures that they would concentrate on heaviest. Could you in a short time, because I don't want to trespass on Bob's time—in fact, I will withdraw the question. Go ahead.

Mr. AuCoin. Let the record show that Brilliant Pebbles is advertised as an off-the-shelf technology.

Mr. McDade. Off-the-shelf of the United States of America, but I don't think you could buy it in a Moscow department store.

Mr. Livingston. That highlights a problem that we are talking about. Mr. AuCoin is fantastic at selecting single incidents in the overall technology. He is very effective in separating an isolated instance. If we could blend today's technology with 1995 technology or the year 2010 technology, a particle beam won't be available to us for ten years and probably won't be available to the Soviets for another ten years after that; is that fair?

General Monahan. The way they can accelerate that is by stealing it.

Mr. Livingston. The particle beam really is not in phase one technology. We are not talking about that. I think that—again, I don't mean to just over-do this business, but I think it is significant. When they send up their missiles and with the Soviets, we are not talking about one, we are talking about a lot of them, they have some 20 minutes of burn time—five minutes of burn time where they are going into the boost stage of the cycle.

The boost stage missile releases a bus which contains a lot of warheads, it goes for awhile, then it releases the warheads and the bus itself travels in the intermediate stage, releases the warheads and they go into the terminal stage.

If we have a Phase I system, we are not talking about particle beams or chemical based lasers, we are talking about a limited number of Brilliant Pebbles which can intercept, if deployed, possibly the bus in the intermediate course, possibly the terminal phase re-entry vehicles and if they are really lucky, they might catch that boost stage right over the Soviet Union when they launched, correct?

General MONAHAN. Yes. I think it is more than just being lucky. I think we can do it.

Mr. LIVINGSTON. The ERIS and the HEDI are groundbased missiles stationed presumably around the continental U.S.

General MONAHAN. Yes, sir.

Mr. LIVINGSTON. They have to zoom up and catch whatever might have gotten through the net.

General MONAHAN. Right.

Mr. LIVINGSTON. It is not likely that they can be used to catch the boost stage or even the bus?

General MONAHAN. No.

Mr. LIVINGSTON. They have to catch individual warheads. How many warheads might we be talking about in a full Soviet attack?

General MONAHAN. The JCS estimates 5,500 in a first wave of a Soviet attack.

Mr. LIVINGSTON. So once we have deployed Phase I, it is not likely that the Soviets are going to have any Brilliant Pebbles.

General MONAHAN. No, oh, no. We wouldn't give them credit for that nor would they have any decoys. They don't have any decoys today. We deliberately are working the problem of discrimination to be able to work against an anticipated threat.

Mr. LIVINGSTON. They don't have any particle beams or chemical-based lasers?

General MONAHAN. Not today.

Mr. LIVINGSTON. Mr. AuCoin postulates that they might have space mines. Space mines are ASATs?

General MONAHAN. Yes.

Mr. LIVINGSTON. I am not going to comment on the fact that Mr. AuCoin says the Soviets don't have ASATs——

Mr. AUCOIN. I said they could get them. They once didn't have MIRVs and we thought MIRVs were great because they didn't have them.

DEFEATING BRILLIANT PEBBLES

Mr. LIVINGSTON. If they don't have particle beams or lasers, the only way they can defeat Brilliant Pebbles is with individual warheads aimed at the Brilliant Pebbles or with a space mine deployed up there permanently. The only way they can deploy those things permanently and be effective is if they park them close to each Brilliant Pebbles, unless they want to blow up a megaton bomb over the Soviet Union, which, to me, sound like there may be repercussions.

If they park them right next to each Brilliant Pebbles, the only way they can do it, since each Brilliant Pebbles is orbiting around the earth, is to be in the same orbit. That means they can't be orbiting sideways with the Brilliant Pebbles because if they are sideways, they are going to get into a different orbit and not be there at the right time.

They have to be in that exact same orbit and if they are there, they have to be either immediately in front or immediately behind that Brilliant Pebble.

Mr. **AuCoin**. I agree with that.

Mr. **Livingston**. When we see Brilliant Pebbles in their respective orbits and we are talking about anywhere from 200 to—how many Brilliant Pebbles are we talking about?

General **Monahan**. About 4,000.

SPACE MINES

Mr. **Livingston**. If they are close enough to wipe out the Brilliant Pebbles, we have capacity to determine whether or not they are there and if they are in the exact same orbit, we have to figure if 200 to 4,000 Brilliant Pebbles are threatened by Soviet space mines or ASATs that may be the Soviets have some malicious intension, so our immediate reaction is to change orbit.

So we change orbit a little bit. We take a little bit of power that is built into the Brilliant Pebbles and we move and we change orbit. So if these 200 to 4,000 space mines decide that they want to catch up in order to be effective, because, after all, the Soviets have spent so much money on them to be offensive weapons to knock out our Brilliant Pebbles, they have to move, too.

I would like Dr. Judd to tell me, what happens when we start moving and they start moving?

Dr. **Judd**. Well, we have certainly done an analysis of that and there are tactics that our system can use that basically is very stressful on them. I think General Monahan can give the better example as an experienced fighter pilot interms of flying——

Mr. **Livingston**. Let me have the fighter pilot answer then. What happens?

General **Monahan**. Any time the leader maneuvers, the wingman has to expend quite a bit of effort to stay with him. When we watch the thunderbirds, it looks like they are very closely glued together.

They are, but if you were up in formation, would see the wingmen moving around constantly.

Mr. **Livingston**. Does the aggressor, which is the Soviet space mine, in this instance, have to have less fuel, as much fuel or more fuel than it takes to maneuver the Brilliant Pebbles?

Dr. **Judd**. It is our feeling that it has to have not only more fuel, but a better technology to be able to catch the other one.

Mr. **Livingston**. So it has to have more fuel and better technology, which means that it has to be heavier and if it is heavier, then it takes even more fuel to maneuver and who runs out of fuel first?

Dr. **Judd**. We would assert that we could win that game.

Mr. **Livingston**. If we had 4,000 Brilliant Pebbles, or just 200—if we had Brilliant Pebbles deployed, and they had 200 space mines, following around and tracking in our orbit and they are running out of fuel, and they have to be more technologically capable, which system costs more, the Soviets or the United States?

General **Monahan**. There is no question that the Space Mine System would cost a lot more.

Mr. **Livingston**. The Space Mine System would cast a lot more and the purpose of it would be to offensively knock out our Brilliant Pebbles before they send up their ICBMs in a first strike. It ain't going to happen. The Brilliant Pebbles works.

Mr. **Murtha**. The time of the gentleman has expired.

Mr. AuCoin.

Mr. **AuCoin**. Dr. Judd, following up on that last exchange, the truth is a space mine would have a smaller payload than a Brilliant Pebble; therefore, there is more room for fuel, therefore, there is going to be more fuel in the space mine than there is in the Brilliant Pebble.

Dr. **Judd**. The fact is, though, that the current Brilliant Pebbles is only carrying a payload of 6 kilograms out of a total of about 40, so the amount of extra fuel that you would carry just for that——

Mr. **AuCoin**. Are you counting sensors and nuclear hardening?

Mr. **Judd**. All of that, yes.

Mr. **AuCoin**. All of that accounts for that weight?

Dr. **Judd**. Yes, 6 kilograms. There is 36 kilograms of Brilliant Pebble fuel. Its total mass is 40 kilograms.

Mr. **AuCoin**. But in the case of the space mine, there is none of that hardening, none of the kinds of sensors that Brilliant Pebbles would need for its robust edition, all you would need is to be able to shoot perhaps with a shape charge weapon at the Brilliant Pebble, which is a savings that gives you more fuel.

Dr. **Judd**. Au contraire! It not only would have to have a sensor, but it would have to have a much better sensor because Brilliant Pebble is hard to see by another Brilliant Pebble. We would assert——

Mr. **AuCoin**. Dr. Canavan said all you would have to do is hold up your thumb to get a sight——

Dr. **Judd**. Provided you can see the other Pebble and chase it, follow it, track it and stay within range of it. We will take a close look at the ideas of a shape charge, but, remember, in space when you fire something straight out, it doesn't follow a straight line, it tends to curve. So one has to take that into account in aiming this thing and we will go do the calculation. But my estimate of that is it is going to be more difficult than what my colleague, Dr. Canavan, suggested.

Mr. **AuCoin**. I think this points out the need for you to move forward on the building of a Brilliant anti-Pebble, so we don't have to do guesstimates, but can actually work the problem.

COMPUTER VIRUSES

How do you protect SDI against computer viruses like we have seen in the popular press that have invaded other systems? I saw some of the computerized nerve center—how do you protect against something like that?

General MONAHAN. I don't know if you are familiar with the programs developed by the National Security Agency in this regard, but we are doing everything in accordance with their standards. We have very rigorous procedures to follow both in development of our software and really the fielding of our software and the way we protect it. So we are adopting all of their security measures. We have their people working on our staff. In fact, I am going to send a liaison officer there, too.

Mr. AUCOIN. Can you submit that for the record?

[CLERK'S NOTE.—The Department was unable to provide a response in time to be printed in this hearing volume.]

BSTS TREATY COMPLIANCE

Mr. AUCOIN. Can you make BSTS verifiably-treaty compliant?

General MONAHAN. Yes.

Mr. AUCOIN. How?

General MONAHAN. Verifiably-treaty compliant, I don't know whether that is possible with any device. There are Soviet satellites up there today and there is no way we can verify that they comply with the treaty. Like the DSP, there is no way they can verify that complies with the treaty. I don't think there is a way to make any of them verifiably-treaty compliant, nor were those kinds of provisions called for in the ABM treaty.

Mr. AUCOIN. In our own judgment, do you think we make BSTS treaty compliant?

General MONAHAN. Yes. The treaty compliance group has just about wrapped up a year-long effort and they have looked very hard to say what does it take to make BSTS treaty compliant. They are about to release within a day or so to me a report. Recall I mentioned earlier that BSTS has its primary mission in tactical warning and attack assessment. There are other missions, nuclear detection, tactical data exploitation and it has a missile defense purpose, but that is not an essential purpose any longer.

The treaty compliant people tell us that you may design and develop a BSTS that has all the SDI features onboard, but you may not deploy it.

We are falling back and saying maybe BSTS can be done cheaper by just putting the tactical warning and attack assessment only onboard.

Mr. AUCOIN. Could you provide those for the record?

[CLERK'S NOTE.—The Department was unable to provide a response in time to be printed in this hearing volume.]

Mr. AUCOIN. Will the START reductions impact your Phase I requirement?

General MONAHAN. They could. Recall the Phase I requirement is sized such that we would intercept ——— in the first wave of a Soviet attack.

JCS tells us they have ——— our estimate of that may change.

IMPACT OF START ON SDI

Mr. AUCOIN. Is it possible to arrive at some early conclusions now as to how the START, estimated START reductions would impact your Phase I requirements?

General **Monahan**. All I can say is this—in my view, the numbers of interceptors, both Pebbles and the ground-based interceptors that will be required to achieve the Phase I requirements will probably be decreased.

Mr. **AuCoin**. Could you expand on that for the record: if our offer on the table were accepted by the Soviets, what that would do for your Phase I requirement?

[Clerk's note.—The Department was unable to provide a response in time to be printed in this hearing volume.]

General **Monahan**. The Phase I requirement is a reference requirement. Whether or not the JCS might change that as a result of START, I don't know. The idea is to blunt the leading edge of a Soviet attack—you know all the reasons for it.

SPACE SURVEILLANCE AND TRACKING SYSTEM

Mr. **AuCoin**. If Brilliant Pebbles works, how important is SSTS? The Defense Science Board says that SSTS should be re-thought. My real question is where is the re-thinking taking place?

General **Monahan**. In the study effort that I mentioned awhile ago, we are going to take a look this year at the mid-course problem and the ground-based architecture as it contributes to mid-course. Last year we looked at boost and post-boost and came out with the Brilliant Pebbles answer. This year we will do that with the mid-course part of the defense and that is one place SSTS will be considered.

Mr. **AuCoin**. What is the cost with or without Brilliant Pebbles?

General **Monahan**. Our estimate is after they are all fielded, and after full operational capability, it is a $1.8 billion a year operating and support cost estimate.

Mr. **AuCoin**. And without Brilliant Pebbles?

General **Monahan**. I don't know that we did it without the Pebbles. Are you talking about when we have the conventional space-based interceptors, the previous system?

Mr. **AuCoin**. Yes.

General **Monahan**. I don't recall.

Mr. **AuCoin**. Can you get those?

General **Monahan**. I can get them, but I can't imagine they would be much different.

[Clerk's note.—The Department was unable to provide a response in time to be printed in this hearing volume.]

BRILLIANT PEBBLES SENSOR

Mr. **AuCoin**. If your office could get that information to me before the time requirements for the record, I would appreciate it.

How significant is the technical risk of Brilliant Pebbles Long Wave Infrared Sensor?

General **Monahan**. The Long Wave Infrared Sensor is not part of the Brilliant Pebbles line. If we should want it to operate mid-course, we will put that onboard. The type of sensor is the mercury cadmium teluride, 64 by 64 array. Used in ERIS, SSTS, and in a couple of other places so it is not a high risk technology.

Mr. **Murtha**. The time of the gentleman has expired.

Mr. Livingston.

SHOOT FIRST POLICY

Mr. **Livingston**. I don't have a lot of questions, but I do think that it is important to touch on this business about the particle beam and whether or not we should shoot first.

Admittedly, the particle beam for us is some ten years away and substantially more for the Soviets, but presumably, an effective particle beam could discriminate between decoys and real RVs and to be used as a weapon to knock the real RVs out of the sky.

Mr. **AuCoin**. You raise a good point. I thought the General said that the neutral particle beam was some ten years away in its weapons mode, but that as a discriminator, it is not as technologically complicated and, therefore, is more near-term?

General **Monahan**. I think we could make it simpler as a discriminator. We don't plan to do so now, but I think we could, if we wanted to.

Mr. **AuCoin**. So in that mode, it is not a technology that is ten years away?

General **Monahan**. The level of technology is the same. It is the power level one would like to put in there and the cost of a huge satellite versus a smaller satellite. To that extent, I think it is more financially-limited than technology-limited.

Mr. **Livingston**. You owe me one. A laser is more offensive, I guess, because it may not be too great a discriminator, although I may be wrong on that——

General **Monahan**. It is a defensive weapon.

Mr. **Livingston**. The point is that the policy would be presumably set on the ground, that these weapons, even though once deployed, would not fire without permission from——

General **Monahan**. Yes.

Mr. **Livingston**. I would suppose the President; is that correct?

General **Monahan**. I will leave that option open to future Presidents.

Mr. **Livingston**. High authority within the Defense—within the Pentagon or the President would have to authorize, otherwise—so it wouldn't be just willy-nilly in the atmosphere firing at anything that came around.

General **Monahan**. Yes.

Mr. **Livingston**. I appreciate your analogy to the high seas. If they put a ship right next to our ship and in every single instance every ship that we had on the high seas we would obviously think that something was up and we wouldn't just wait for something to happen, we would be alert.

Once you are talking about lasers and particle beams, you are also talking about Brilliant Pebbles, ground-based interceptors, about any other weapon that may be available by that time and you are not going to look at an isolated instance.

You are going to look at the whole scenario and presumably you are going to know that another nation is mobilizing to come at us and we are going to have opportunities to fire back and even though we might lose a particle beam or a laser or several Brilliant Pebbles, we will have other assets to contain the threat?

General **Monahan**. Yes.

Mr. **Livingston**. And to retaliate?

General **Monahan**. Indeed.

Mr. **Livingston**. I thought that was important to complete the picture that Mr. AuCoin had painted.

Mr. Chairman, I don't have any specific questions. I think that Mr. AuCoin may. But I would like the opportunity just to engage in discussion from time to time as he just did, if he raises additional points which I think are worthy of rebuttal.

Mr. **Murtha**. Mr. AuCoin.

Mr. **AuCoin**. One thing I hope the committee will keep in mind, and I think that Congress is going to have to keep in mind, and that is that as we take into account the potential countermeasures to SDI, because their effectiveness is going to determine whether this is a good investment to make or not, it is not really doing ourselves a service by just taking a snapshot today of what the Soviets have.

When we went ahead with MIRVed missiles, the Soviets didn't have a MIRV capability, but they got one and I think as we make SDI decisions, we can't just brush off a countermeasure because that countermeasure is not now in the possession of the Soviets.

The point is if we create a new reality as in military history, a new reality, and SDI would present one, then we need to anticipate what countermeasures the Soviets would do that they may not have now.

So in the instances when my friend from Louisiana indicated the Soviets do not now have space mines, do not now have other kinds of countermeasures, I would agree with him. The point is we need to anticipate the fact that just as in the case of the MIRV technology, if we put something as robust as SDI up there with inherent offensive capability against their assets, we need to anticipate what countermeasures they would move to.

Mr. **Livingston**. I have said consistently that the Soviets do have ASATs.

Mr. **AuCoin**. They don't have space mines.

Mr. Chairman, I have no further questions.

Mr. **Murtha**. This has been a brilliant discussion, really enlightening.

Mr. **AuCoin**. I can tell you have been thrilled, Mr. Chairman.

Mr. **Murtha**. No. I have sat here for over ten years and this is as good a discussion as I have heard on any subject. You two have spent a lot of time on this. The committee is indebted to you because this will be one of the vital subjects discussed this year and we appreciate the time that both of you have spent on this very important subject. We appreciate the work the staff has done. It really has been very helpful to us and I appreciate it.

Mr. Miller.

RAIL GUNS

Mr. **Miller**. Thank you, Mr. Chairman.

In the past, about four years ago I would say, we had people in general, doing the same thing that you are doing. We were talking about power and energy at that time and it was indicated that extreme energy would be needed in order to fire the rail gun. Are we still researching the rail gun?

General **Monahan**. Yes, indeed we are. We are pursuing hypervelocity rail-gun type research and some of it looks very promising.

The Air Force is doing so at Eglin Air Force Base. Sandia National Laboratory is pursuing it with contractors in California and we have a cooperative program with the Dutch.

Mr. **Miller**. The energy and the power that would be needed for that, have we found a system to furnish the power to be able to fire the rail gun?

General **Monahan**. It is not so much power as getting the power packaged into densely packed capacitors. We are working hard on that and I think we have made some strides. A bigger technical problem is how to alleviate the heat down the barrel and to point it accurately.

It is looking more possible now than just a couple of years ago and it is more financially limited than anything else at the present time.

SPACE POWER

Mr. **Miller**. One area that you indicate as having achieved major technical accomplishments, during the period from 1984 through 1991, is in space power. Specifically you mention developments in high voltage components in space environment and high voltage space power.

Why do you need high voltage power? It seems as though you would be working under a handicap because power is more likely to leak out, break through insulation in the lower atmosphere. Are high voltages something that absolutely you must have?

General **Monahan**. No. In space, we are going to operate certain hardware. For example, if space-based laser came along, you would need high levels there. We have a lot of basic research getting into a fundamental area of just space power. What we would like to do is increase what we call the density, in other words, the amount of electric power that can go into small packages and we have made some very, very big improvements there.

Today's satellites use solar panels and they can do the job quite well, but they are vulnerable, big, and flimsy, easy to see. We are working on solar power systems, a program called "Super", where we can really do a solar-type energy collection scheme using solar energy. But we won't have to use the panels. We will use very, very small collectors grouped together on the back of the satellites and thereby we remove a major deficiency.

Mr. **Miller**. The solar panels, I can visualize, would require panels that perhaps would be 40 feet long by 20 feet wide and there we are talking about a lot of weight that would be necessary.

General **Monahan**. Yes. If you can get away from the panels, we would certainly like to do so, and that is why we are concentrating efforts in that area. We have a number of efforts looking at ways of packaging the power-generating systems much smaller.

Mr. **Miller**. Are you working on a panel that would be more efficient where we would increase the amount of energy that comes from the sun?

General **Monahan**. Right. We are working on devices and they won't quite look like panels anymore. We won't have long panels strung out, they will be mounted on the back or side of the spacecraft.

We use sunlight collecting devices that use mirrors and cavities—they use optical systems to gather in the energy from the sun and focus it properly and create the electric energy for us.

Mr. MILLER. Would we have different ingredients going into those panels than what is used now?

General MONAHAN. Yes. They would have different materials. I can't recall all the details, but you would have different material.

COST SHARING WITH ALLIES

Mr. MILLER. I have a couple of other questions about our allies, and how they are cooperating with us on the space program.

I wondered to what extent are we having cost sharing with the allies?

General MONAHAN. We have very little in the way of cost sharing efforts with our allies in this program. We have agreements with about four or five of the countries and we have a lot of contractors, for example, in the United Kingdom, about 100 contracts there, but they only amount to $68 or $70 million.

With our other allies in Europe and Japan, we have industry participation that either the United States Government has contracted with them or some of our contractors have sub-contracted with them. They are mostly small technology efforts, but they are very valuable to us. We are getting an awful lot in the way of technology from overseas in this program.

Mr. MILLER. With so many contractors and so many contracts that you have, it would be helpful to the committee if we had a list of at least the major contractors?

General MONAHAN. We can do that, certainly.

[CLERK'S NOTE.—The Department was unable to provide a response in time to be printed in this hearing volume.]

SECURITY

Mr. MILLER. You have so many other people that are involved in this. I don't know how we will be able to keep it secret and have so many people outside the Government working on the project?

General MONAHAN. We have various levels of classification within the project. We think there are the equivalent of 28,000 people in this country that work on it today. And if they work in an area of the program that requires a security clearance, then they have to have that before they get into it.

Security is always something that requires an awful lot of attention. With our executing agents, the Army and Air Force, we rely upon their security systems.

Within our organization, SDIO, in the basement of the Pentagon, we have a good security system.

Mr. MILLER. I think that is very important because if the Soviets, for example, are not up to where we are, maybe ten years behind, they are going to try to find a way to steal that information.

General MONAHAN. The security system gets down to the reliability of individual people.

BUDGET REDUCTION

Mr. **Miller**. Let me ask, General, the question about the $4.47 billion that is in the budget for SDI. What would you have to cut or what would you have to drop if a billion dollars or a billion-and-a-half was removed from that program?

General **Monahan**. I would probably first go back to the leadership, the Administration, perhaps the President, to see if they had different guidance because a cut of that sort would have a major impact on us. We would either have to stretch out our Phase I efforts. We would have to either stretch out the ground-based part or the space-based part, or both, about the same amount, something of that sort. Or you would have to stretch out the directed energy weapons programs, the lasers, neutral particle beams, et cetera. We would cut back, I think, severely on our Theater Missile defense work, work that we are doing with the allies. Those are examples of the sorts of things that we would have to do. It would depend then upon the guidance that we got from the leadership and the Administration as to what approach they would like for us to take.

Mr. **Miller**. Just one other comment—in one of the documents supplied question and that question to the Committee there are only five pages, perhaps six that are classified and the rest are unclassified.

General **Monahan**. Yes.

Mr. **Miller**. If we could have those unclassified slides, it would be very helpful, because here we have information that tells of the commercial fall-out of SDI research and how domestic problems can benefit from the supercomputer speeds that you are achieving. So this is something that we are getting out of the SDI program that is not just protection, but it would help our economy as we move along.

General **Monahan**. I would be very happy to provide an unclassified version of this to the Members.

[**Clerk's note**.—The information was provided for the Committee's files.]

Mr. **Miller**. Thank you.

Mr. **Murtha**. Mr. AuCoin.

Mr. **AuCoin**. I would be remiss if I didn't express my own appreciation to the General for 35 years of distinguished service to his country. I know his retirement has been announced, I guess it is coming up the first of July. I want you to know I wish you the very best in retirement. I want to express my thanks to you for the service you have rendered your country. You are the second Director of SDI, and though we haven't always agreed, I think that you have done a professional job. I certainly think you have rendered your country a service over the length of your distinguished career. I want to express those views to you at what I anticipate will be the last time you come before our hearing.

General **Monahan**. Thank you very much, Mr. AuCoin. I really appreciate that.

Mr. **Murtha**. We will have other questions for the record. The committee is adjourned until 1:30 p.m. Tuesday.

[Clerk's note.—Questions submitted by Mr. Young and the answers thereto follow:]

BOOST SURVEILLANCE AND TRACKING SYSTEM (BSTS)

Question. General Monahan, there is considerable discussion in the Congress about the Boost Surveillance and Tracking System (BSTS) and its applicability to the SDI program in view of your statement earlier this year that its role as a critical node to strategic defense has diminished with the adoption of Brilliant Pebbles.

Some are suggesting that we abandon BSTS in favor of an upgraded DSP program. Your prepared statement makes a rather strong argument in favor of continuing the BSTS program.

In some respects the world has changed dramatically since SDI was first envisioned, but in the Strategic weapons area, every witness who has testified before this committee has stated rather strongly that there is no decrease in Soviet activity with regard to strategic modernization.

Would you clarify for the committee the BSTS role? Do we still need it? What shortcomings of the DSP would it correct? At what cost?

Answer. SDIO has concluded that, with the adoption of the Brilliant Pebbles based ballistic missile defense architecture, the BSTS space-based early warning sensor is no longer an essential element of the Phase 1 SDS. BSTS is, however, crucial to resolve long standing deficiencies in Tactical Warning/Attack Assessment (TW/AA) requirements that ———. Application of today's state-of-the-art technology frees the early warning system from overseas bases, requires fewer personnel to operate, provides more detailed information to using commanders, and has a lower life-cycle cost. We are also aligned to protect the option for growing into a future BMD support role for BSTS. The yearly costs for the TW/AA program are, especially in the early years, virtually unaffected by removal of the BMD requirements. Of the roughly $8.8 billion (in BY88 dollars) for BSTS acquisition, approximately $.2 billion are attributable to unique BMD features.

Question. What would be the cost for upgrading DSP to satisfy the advanced tactical warning and attack assessment requirements?

Answer. Satisfaction of the TW/AA requirements cannot be achieved through a simple upgrade to the DSP program. As determined by the DoD review group responding to a Congressional report request in the 1988 appropriations legislation, the costs and risks associated with the amounts and scope of upgrades that would be required in the DSP program are equivalent to continuing to pursue BSTS development. In any case, the Air Force will be conducting a free and open competition to select the single contractor and design to carry into full scale development to satisfy the TW/AA mission.

Question. If Brilliant Pebbles is selected for the SDI mission will BSTS still be needed for other parts of the mission?

Answer. ———.

Question. What is the cost of Brilliant Pebbles vs. BSTS?

Answer. The Brilliant Pebbles acquisition cost (in FY88$) is $12 billion vs. the BSTS acquisition cost of $8 billion. The launch costs through the production phase are $2.6 billion and $2.0 billion, respectively.

Question. How do the developments in the Middle East—with regard to many of the countries in that region acquiring improved missiles—affect the decision about whether we should go with BSTS or an improved DSP?

Answer. ———.

Question. When is the proper time to make a decision about whether we should continue with BSTS or go with an improved DSP?

Answer. BSTS will complete its demonstration and validation phase next year. The program, fully ABM Treaty compliant, is ready to enter Full Scale Development (FSD) to fulfill the TW/AA mission. Concurrently, BSTS is structured to protect a decision for possible future use within strategic defenses. BSTS is scheduled to go before the Defense Acquisition Board (DAB) early in FY 1991 and the Department will be releasing an RFP to begin selection of a full-scale development contractor. The DAB will review options for satisfying the mission requirements. The source selection authority will make the decisions regarding the design and contractor that best meets these requirements.

[CLERK'S NOTE.—End of questions submitted by Mr. Young. Questions submitted for the record and the answers thereto follow:]

PRESIDENTIAL DIRECTIVE

Question. In June, 1989 a Presidential Directive concerning SDI and other strategic programs was issued to DoD, DoE, and other Federal agencies. General Monahan, please explain the goals for the SDI program that are required by this new document.

Answer. President Bush called for a comprehensive review of national security strategy and objectives, including SDI. Following that review, the President issued guidance with respect to the SDI program. That guidance affirms that the goals of SDI remain sound. The directive states that SDI should develop options for strengthening deterrence and stability through the deployment of strategic defenses based on advanced technologies. SDI should also provide a hedge against any Soviet decision to expand rapidly its anti-ballistic missile capability beyond that allowed by the ABM Treaty.

The Presidential directive provides for an informed decision on deployment of strategic defense by mid-1993. It specifically directs Department of Defense to pursue options for layered defenses, consisting of both space- and ground-based elements, recognizing that layered defenses offer substantial advantages in terms of defense effectiveness and imposing uncertainty on Soviet warplanners. It directs the Department to place emphasis on program flexibility and continue toward deployment of a system that will meet the requirements of a Phase I Strategic Defense System as those requirements have been defined by the Joint Chiefs of Staff by focusing on evaluating the potential of the most rapidly advancing boost-plan defensive technologies such as Brilliant Pebbles.

The directive notes that survivability of defensive systems should be sufficient to ensure that the Soviets would have little incentive or prospect of achieving their war aims by attacking them. Any deployed system also should provide clear economic and other disincentives to attempts to counter them with additinal offensive forces.

The President further directs that the SDI program be conducted in full accordance with all U.S. international obligations, including the ABM Treaty.

Question. How much funding does this directive require for SDI in the five year defense plan?

What would be accomplished with the level of funding?

What will not be accomplished under this lower funding profile?

Answer. In 1989 the President directed that no less than $33 billion set aside for SDI in the FY1990–94 FYDP.

This level of funding will continue research and development on a broad range of maturing and advanced technologies. Research to demonstrate and validate elements of the Phase I system is balanced with tests and experiments for follow-on concepts such as directed energy technologies. The program is focused on reducing technical risk in areas such as target signatures against a variety of back-grounds, communications, radiation hardening, space power, and system integration.

Lower funding would force us to make premature down-selects between competing (and promising) technologies; reduce overall technical confidence; and slip some schedules. In addition, additional funding reductions would adversely affect our ability to carry forward a balanced programs.

Question. In June, 1989 a Presidential Directive concerning SDI and other strategic programs was issued to DoD, DOE, and other Federal agencies. What is the specific guidance on "Brilliant Pebbles?"

Answer. ———.

Question. When is an SDI deployment decision envisioned by this document? What exactly does "deployment decision" mean? What kinds of options will be available to the President to choose among?

Answer. The President has stated that the Strategic Defense Initiative would remain a robust program within fiscal constraints. His guidance directed that the SDI program be conducted in a way to permit the President to make, within four years, an informed decision on deployment of strategic defenses. Based on this guidance the program is structured to support a Presidential decision.

FUNDING

Question. The budget requests $4.5 billion in the defense bill for SDI. General Monahan, tell us briefly how these funds are to be used.

Answer. The FY 1990 SDI Budget: follows Presidential guidance and Congressional language; permits Presidential deployment decision by mid–1993; maintains balance between ground- and space-based layers and between Phase I and Follow-on elements ——— and is fully compliant with the ABM Treaty.

The FY 1991 Surveillance, Acquisition, and Tracking budget continues tests on the Space Surveillance and Tracking System (SSTS), provides additional funding for sensor development in the Ground Surveillance and Tracking System (GSTS), increased discrimination technology tests, and increased sensor studies and experiments, which are critical to the design of all surveillance and weapons sensors in the Strategic Defense System. Additional funds are also required for Ground-based Radar (GBR) tests in FY 1991 to provide key technology support for GBR development. We complete demonstration and validation on the Boost Surveillance and Tracking System (BSTS) in FY 1991.

The FY 1991 Directed Energy budget request continues work on the Free Electron Laser, increases funding for the Chemical Laser and Neutral Particle Beam to provide for the design, fabrication, and testing of numerous technology demonstrations, and integration of results into other SDIO programs.

The FY 1991 Kinetic Energy budget continues funding for the Ground-based Interceptor, and provides additional funding on interceptor integration components and interceptor studies and experiments. It also provides for pre-FSD contracts for concept definition of Brilliant Pebbles, and adds funds for the High Endoatmospheric Defense Interceptor (HEDI) program flight tests planned for FY 1991.

The FY 1991 Systems Analysis budget also provides funds to begin implementation of the Command center, provides additional funds for a Level II Systems Simulator, and extended air defense theater test-beds. It provides continued funding for communications engineering, systems integration and engineering, architecture studies, and the National Test Bed.

The FY 1991 budget request for Key Technologies includes additional funding for survivability, lethality and target hardening studies, power conditioning, materials and structures development, innovative science and technology, and countermeasures studies.

A new program element is included in the FY 1991 budget request for Full Scale Development. The first project requesting funds under this program element is the Boost Surveillance and Tracking System (BSTS) which is required for TW/AA and other non-ballistic missile defense roles.

Question. There is about a $.9 billion increase from 1990 to 1991 SDI funding levels. What are the main areas of growth?

Answer. The FY 1991 budget provides for necessary funding to support Phase I (BP, BSTS, GBR, GSTS, CC/SOIF) and Follow-on (Space laser, NPB, HEDI, interceptor components) programs.

Question. Describe the balance between nearer-term technologies (like Brillant Pebbles) and longer-term technologies (like directed energy weapons).

Answer. SDI is a broad-based program. The more mature technologies, such as kinetic energy weapons (KEW) are currently in demonstration and validation (DEM/VAL), while advanced technologies, such as directed energy weapons (DEW), are in concept exploration.

SDIO has structured the program to provide for parallel, but phased, development. That is, as Phase I technologies move into

Full Scale Development (FSD), some advanced technologies would enter Dem-Val.

This approach would allow for the timely development of advanced follow-on systems to offset potential Soviet countermeasures to a Phase I system.

Question. How much annually will SDI require in each of the next five years, according to your current plan, in then-year dollars? When is the peak year?

Answer. The current SDI program calls for the following funding (including MILCON and procurement). ———.

Question. Describe specifically what specific work was not done as a result of fiscal year 1990 Congressional budget reductions to SDI.

Answer. The reductions were spread over dozens of programs; however, the top 10 were:

	Millions
Space transportation	$70
Endoatmospheric interceptor	67
Power & power conditioning	47
Discrimination technology	47
Sensors studies/exp (MSX)	44
Innovative science & tech	43
Interceptor studies/analysis	42
Survivability assessment	34
CC/SOIF systems	34
Free electron laser	32

Question. The Committee understands that SDI will still achieve an early 1990s deployment decision in spite of funding reductions by both Congress and the Administration from the original plan. How is this possible?

Answer. The President could make his decision today. As I have stated before, the technology to build and deploy a Phase I SDS is available. Between now and the time the President makes his decision, we will endeavor to increase the range of options available to the President, and to improve the precision of the information on which the decision is based.

ABM TREATY COMPLIANCE

Question. ABM treaty compliance is a key issue for SDI in the long term. What does the recent Presidential Directive require for SDI in terms of compliance with the ABM Treaty?

Answer. The President specifically directed that the SDI program will continue to be conducted in full compliance with the ABM Treaty.

Question. Does this mean strict compliance with the "narrow" interpretation?

Answer. While the Administration continues to support the broad interpretation, we do not seek a divisive, theoretical debate on the interpretation of the ABM Treaty. Rather, we wish to identify and implement the best technical program for SDI consistent with US obligations under the ABM Treaty. If the program raises questions with regard to the so-called broad interpretation of the Treaty, we will address those questions with Congress at that time and on the basis of the specific program we have proposed.

Question. Under your current plan, at what point does SDI first experience a potential problem with ABM Treaty compliance?

Answer. All field tests must be approved for ABM Treaty compliance through the DoD compliance review process. To date, no tests conducted by SDIO have been found to be inconsistent with the ABM Treaty. Furthermore, the President has directed that the SDI program will continue to be conducted in full compliance with the ABM Treaty.

Question. Describe the treaty compliance issues with the BSTS satellite, which is proposed to be moved into full scale development in the fiscal year 1991 budget. How do ABM Treaty considerations affect its: design; testing; deployment?

Answer. ———.

Question. What are the ABM Treaty compliance issues with "Brilliant Pebbles"?

Answer. Each SDI test or series of tests is examined on a case-by-case basis to consider the specific test plans and the application of the ABM Treaty to those plans. The test program for the Brilliant Pebbles is being evaluated for compliance as it is being defined. To date Brilliant Pebbles ground-based testing has been approved through flight number 8. The plans for subsequent tests are currently being evaluated for compliance purposes.

Question. What is the long term solution to SDI's conflict with the ABM Treaty?

Answer. The SDI program, a research and technology development program, will continue to be conducted in compliance with the ABM Treaty, and the long term solution to resolving applicable ABM Treaty issues will be to continue to rely upon the guidance of the Department of Defense Compliance Review Group. Solutions of broader issues with the ABM Treaty will necessarily require involvement of higher level authority.

SDI IN A START ENVIRONMENT

Question. The prospect for a START treaty for offensive nuclear weapons was not likely when SDI was begun. It is likely now. All DoD weapon systems are designed to counter a specific threat. What is the current threat the Phase I SDS is to counter, and how has this changed since the program was begun?

Answer. Phase I is designed to counter the threat posed by Soviet ICBM forces by deterring an attack. Specifically, Phase I would be capable of destroying ——— of SS–18 warheads and a significant percentage of remaining Soviet ICBM warheads. Phase I would also provide more comprehensive protection against the growing threat posed by ballistic missile proliferation.

Question. Given START reductions, could the U.S. deploy layered defenses that are more modest and less costly than the current Phase I architecture?

Answer. Yes. Because of our efforts in technology development and producibility, we expect further reductions in the cost of Phase I even without START reductions. The design of the Phase I architecture is a function of the mission assigned to it and the threat against which it must operate. The mission for the Phase I SDS was approved by the Joint Staff for a non-START environment and would be subject to re-evaluation once a START treaty was approved. Under a START environment, the size of the threat, in terms of numbers of warheads, would be reduced. However, within the numerical constraints of a START treaty, the Soviets would have considerable latitude as to the quality of the force they choose to field. At a minimum, we would expect them to keep the most modern portion of their inventory, but they could also choose to make significant improvements to their smaller force. These improvements could include faster burning missiles, multiple post-boost vehicles on their heavy boosters, and off loading of RVs to allow more midcourse penetration aids (penaids).

Analyses to date indicate the size of the Phase I SDS architecture will be driven as much by the quality of the Soviet force as by the quantity. If we assume a START force composed of only weapons currently in the Soviet inventory, the current architecture does considerably better than the JCS mission. Furthermore, if we assume the Soviets take steps to reduce the effectiveness of the SDS, then the current architecture still meets the JCS mission.

Question. How does a deployed SDI system provide "insurance" against Soviet cheating on a START treaty?

Answer. Extra weapons obtained by cheating could be employed to increase the size of a first attack aimed at destroying our retaliatory capability or they could be maintained for strategic reserve to be used to force an outcome favorable to the USSR after the initial exchanges. At reduced numbers of forces even small numbers of covert ballistic missiles can be significant. By employing an adaptive preferential defense strategy with the Phase I SDS, the U.S. could protect assets which we valued. This denies the Soviet planners a high level of confidence in achieving their objectives even if they employ more weapons than allowed under the START treaty. If the Soviets maintained the extra weapons as a reserve, they would still be subject to destruction, when employed, by the remaining Brilliant Pebbles and ground-based interceptors. As such, deployment of defenses provides a disincentive for Soviet cheating.

Question. How does SDI help to counter an increasingly mobile Soviet ICBM Threat?

Answer. The Soviets employ mobile missiles for several reasons. They are difficult to find, which makes them relatively invulnerable to missile delivered warheads and difficult to count (see answer to cheating question above). Since they may survive an initial ICBM/SLBM exchange, mobile missiles are useful for maintaining a reserve for subsequent exchanges. Soviet mobile missiles are subject to destruction during boost and post-boost by the Brilliant Pebbles constellation, even if they are not used in an initial attack. Therefore, defenses, and particularly space-based defenses, appear to be a cost-effective means of targeting these hard-to-find Soviet mobile missiles without threatening their pre-launch survivability.

Question. Explain how SDI provides an incentive for "de-mirving" offensive ICBM missiles?

Answer. When a SDS is deployed, attacking Soviet missiles will be subject to destruction by the Brilliant Pebbles (BP) during their boost and post-boost phases. If a missile is destroyed during boost, all of its RVs will be destroyed. Destruction of the post-boost vehicle (PBV) results in destruction of how ever many RVs remain on the PBV at the time of intercept. Thus one Brilliant Pebble can destroy many RVs if the missile is mirved. To maximize penetration of the BP constellation the Soviets could choose to use single missiles at a greatly increased cost per launched warhead. This would, however, increase the effectiveness of ground-based interceptors.

Question. It looks like there may be large funding reductions to the fiscal year 1991 Defense budget, which may jeopardize Congressional support for either MX-rail garrison or the Small ICBM. If Congress were to terminate both, how would this change the relative importance of SDI?

Answer. The basic importance of SDI does not depend on whether the Congress supports Peacekeeper rail garrison or the Small ICBM, but on the evolving capability of the Strategic Defense System (SDS) to deter and protect against nuclear ballistic missile attacks, both by the Soviet Union and by third parties. As such, SDS should not be thought of as an alternative to Peacekeeper rail garrison or Small ICBM/HARD Mobile Launcher (HML) deployment, but as an integral part of a more balanced U.S. deterrent capability. Both SDS Phase I and the strategic offensive modernization program (including Peacekeeper Rail Garrison and Small ICBM) will serve to complicate an aggressor's nuclear attack planning. SDS Phase I, however, will offer the unique capability of intercepting ballistic weapons inbound to targets in the United States, the territory of our allies, or that of third countries. Finally, SDS is designed to shift away from the threat of inflicting offensive retaliatory damage for ensuring deterrence towards a more balanced offense/defense force posture that places greater reliance on strategic defenses to ensure deterrence.

Question. MC in rail-garrison is highly vulnerable to a no-warning surprise attack.

a. What would be the impact on the STOP if a large fraction of the MX force was eliminated in such an attack? Could the U.S. still conduct a favorable nuclear exchange?

b. Given that the goal of SDI is to intercept only a certain fraction of incoming warhads, to what degree do you forecast that SDI will eliminate such a threat to MX rail-garrison?

c. In a post-START environment where both sides have parity in nuclear delivery vehicles, who has the advantage in a nuclear exchange: the aggressor or the defender?

d. How does the deployment of an SDI system on one side change this balance?

e. How does the deployment of equivalent SDI systems on both sides change this balance?

Answer. a. SDIO suggests that this question be referred to the Joint Chiefs of Staff or the Strategic Air Command for a more comprehensive answer.

b. In a broader sense, SDI enhances stability by defending vital U.S. assets against a Soviet attack. While SDS is not specifically designed to defend the Peacekeeper in rail-garrison, a deployed SDS will provide significant uncertainty for Soviet planning of a counterforce attack. Not knowing which of their first-strike warheads would reach their intended targets may well create enough doubt of mission success to deter such an attack in the first place.

However, if a surprise first strike is launched, the SDS operator can employ the tactic of adaptive preferential defense and selectively intercept those warheads it sees targeted against our most vial national assets. This ability to decide what to defend in real time creates a unique benefit for the defender: it would force the attacker to allocate substantially more warheads to his priority targets than would be required in the absence of defenses, reducing the number of targets he would otherwise be able to attack.

c. No advantage can be gained from initiating nuclear war. A nuclear war will cause unimagined devastation to both the attacker and the defender. It therefore has been a consistent U.S. policy to reduce the risks of initiating such a conflict. This has traditionally been accomplished with a combination of strategic modernization and arms control. Advances in defensive technologies have reached a point where defenses could significantly improve our ability to reduce the likelihood of war and place deterrence on a more stable footing, and reduce damage to the U.S. should deterrence fail.

d. It is the policy of the United States government to encourage a mutual deployment of defenses that will place the U.S.-Soviet strategic relationship on a more stable footing. We have taken steps to pave the way for this cooperative transition in the Defense and Space Talks (DST). It cannot be thought disadvantageous to defend oneself. The Soviets realized this long ago and deployed a limited ABM system in 1972 and also have the most extensive air defense system in the world. An initial SDS deployment will create great uncertainty in the mind of a potential aggressor about the ability to achieve his offensive war aims. This issue is not whether only the U.S. will have a defense, the issue is whether the U.S. will cede a unilateral advantage to the Soviet Union in this area—with grave consequences for stability and U.S. security.

e. Mutually deployed strategic defense systems would make both sides more confident in their security and less likely to act precipitously in time of tension; while in peacetime they pave the way for increased U.S.-Soviet cooperation and offer both sides protection from accidents and irrational acts from any quarter.

COUNTERMEASURES

Question. Last year General Monahan testified "Since Brilliant Pebbles is still in the conceptual and design stage, a specified set of countermeasures has not been defined. A study of potential countermeasures against Brilliant Pebbles is expected later this year."

The final Defense Science Board (SDB) report on "Brilliant Pebbles" in December 1989 said the following: "We suggest that more attention be paid to countermeasures and, in particular, suggest that Red Team efforts be augmented and continued throughout the exploratory period."

What specific countermeasures to "Brilliant Pebbles" did the DSB examine?

What specific deficiencies did they discover?

What specific actions are you now taking as a result?

Answer. The Defense Science Board considered many countermeasures including: ———. They reviewed the JASON work as well as the initial outputs of the Red/Blue Countermeasures assessments.

The Defense Science Board determined the Brilliant Pebbles approach to be capable and innovative without any basic flaws. The Defense Science Board, as well as other independent review panels, recommended that the red/blue countermeasure analysis effort continue to be emphasized. We will continue to develop the Brilliant Pebble design in a responsive, validated threat environment.

Question. General Monahan, please tell the Committee what were the results of your Brilliant Pebble's countermeasure study.

Answer. Two rounds of Red/Blue exercises for Brilliant Pebbles (BP) were sponsored by SDIO from July to October 1989. Many candidate countermeasures were proposed during this period. Brilliant Pebbles was quickly fund to be inherently resistent to most countermeasures. ———.

Question. Last fall a review of "Brilliant Pebbles" by the JASON group of scientists stated on the issue of countermeasures: "Anyone can invest in countermeasures, but answering the question of which ones really work must (in most cases) await detailed studies and engineering development; those which are effective may be too costly; and there may be effective countermeasures. Only a full red/blue team study with the best available people on both sides can really address these crucial issues, but there are some countermeasure concepts which we recommend for further study."

Which specific countermeasure did the JASON group tell you required further study?

Answer. The countermeasure concepts recommended by the JASONs for further study were: ———.

The countermeasure concepts suggested by the JASONs group have been provided as input to the red/blue countermeasure group. Countermeasures determined to be potentially stressing to the defense system were then addressed in detail. Others of the suggested JASON countermeasures have been dismissed or retracted by the Red Team as unlikely or ineffective.

As a result of the JASONs recommendations, as well as recommendations from other independent review panels, the red/blue countermeasures analysis effort will continue.

Question. How much is budgeted in fiscal year 1991 for countermeasures work, and how will these funds be used? Provide a detailed breakout for the record.

Answer. The countermeasures budget for FY91 is $22 million broken out as follows:

Red/Blue Analysis $3 million (complete analysis of Brilliant Pebbles, initiation of Phase II analysis);

Tech Studies and Modeling $6 million (IR/radar sensor spoofing, GBR ECM/chaff, IR obscurants, plume modifications, IR engagement signatures, microdynamics signature, sensor requirements PBV/RV acquisition, decoy and CSO sensor requirements). ———.

Question. We discussed at the DARPA hearing the possibility of having DARPA perform the SDI "red team" countermeasures work as a means of ensuring a thorough, independent assessment. The DARPA director refused to comment. What is your opinion of such an approach?

Answer. We have given considerable thought to the best placement for SDI's countermeasures program and have concluded that the best balance between revelance to actual blue concepts and independence is achieved by placing the program within SDIO but funding it as a separate entity and having the Director of Security, Intelligence and Countermeasures, who oversees it, report directly to me. I believe this has worked well and that our "red team" participants have been vigorous and unfettered in probing our blue concepts and designs for weaknesses.

THIRD WORLD THREAT

Question. If deployed, SDI might offer protection against a small ICBM attack from a third world nation. What plans does SDIO have to pursue a "limited protection system" for accidential or deliberate launch from a third world nation?

Answer. The SDIO currently has no plans to pursue a "limited protection system" (LPS) as an end in itself because we do not have a validated military requirement for such a system. We have, however, studied the capability of the full Phase I deployment against limited attacks. The Phase I system provides a high degree of protection against small accidental or deliberate third world attacks which might reach the continental United States. Partial Phase I deployments provide varying degrees of protection depending upon how many interceptors are deployed, where they are based, where the threat is from, and what is being attacked.

Question. Have you constructed a scenario for defending against a third world threat? If not, how do you know how to design an SDI system to meet that threat?

Answer. Using intelligence data available on third world ICBMs, we have constructed hypothetical launch trajectories directed toward the Continental United States from Central America, Northern Africa, the Middle East and Central Asia. It is important to note that we have asked the intelligence community for more refined threat data as it becomes available.

Question. How does protection from a small, third world threat differ from the Phase I architecture in terms of the number of assets that SDS would have to deploy?

Answer. The answer to this depends on whether one only wants to defend the Continental United States (CONUS) against ICBM class threats or whether world wide protection against theater class threats is also desired. Third world theater class threats are small, short-range, and low velocity when compared to the Soviet ICBM threat that the SDS is designed to meet.

Protection of CONUS against small, third world ICBM threats differs in several respects from the Phase I system. First, and most importantly, is the desired level of protection. The Phase I SDS is designed to achieve the JCS mission of destroying specified percentages of Soviet RVs out of a large attack, thus denying the Soviet planners confidence in achieving their attack objectives. In defending against small, third world attacks, much higher protection would be required, necessitating multiple shots at each RV. Second, the Soviet attack is almost exclusively from the North, while the third world attacks could be from any direction to anywhere in the

U.S. Thus, more sensor coverage will be needed in this case, and interceptors may have to be deployed in a number of locations.

Finally, the timeline for release of the SDS assets against the attacking force must be considered. For the Soviet attack, detection of a massive Soviet raid would result in a human decision to release the Brilliant Pebbles to begin the defense. For a single third world booster, the intentions might not be as clear and more time could be required to make a decision to attempt an intercept. Thus, the opportunity to shoot at the booster might be lost. The implication could be a greater reliance on mid-course intercepts in space and on the ground-based tier. All in all, to provide very high protection against all possible Third World limited attack scenarios may require more sensors and a different basing scheme for the interceptors. These issues are presently under study by the Department of Defense.

Question. In 1989 Rand did an analysis of the Limited Protection System. What were the findings concerning LPS under the ABM Treaty without modifications to existing ground-based radars?

Answer. ———.

Question. What radar modifications could be done under the ABM Treaty, and how would this improve the ability of a LPS to perform its mission?

Answer. ———.

Question. What did Rand say about a "madman" launch of SLBMs or a regiment of ICBMs that saturates the 100 interceptor limit imposed by the treaty?

Answer. The study did not examine the capacity of the LPS to handle multiple weapon attacks, but observed that of course a "madman" launch of a boatload of SLBMs or a regiment of ICBMs would saturate the 100 interceptor limit imposed by the treaty and undoubtedly some warheads would get through.

HUMAN COMMAND AND CONTROL

Question. Public Law 100–180 discusses the requirements for keeping a human "in the loop" and to not allow an automated SDI response to a ballistic missile attack. Command and control of a highly distributed system such as "brilliant pebbles" is one of the more controversial and challenging aspects of the system. What is "brilliant pebbles" battle management/command-control-communications structure?

Answer. Human in-the-loop is the basic premise of the Brilliant Pebble command and control structure. For an intercept to occur, the human in-the-loop must provide two key controls: (1) weapon enablement and (2) weapon release authority.

An autonomous Brilliant Pebble will be able to survey approaching targets, select probable intercepts, deconflict with adjacent weapons and once the weapon is enabled and release authority is provided, the Brilliant Pebble will proceed to its selected target. This feature of the Brilliant Pebbles is unique since earlier proposed weapon concepts required guidance updates from an external sensor.

Question. If a Brilliant Pebbles architecture is deployed and the pebbles are autonomous, what will be the role of the commander other than to enable the system?

What decisions will he or she make?

How much time will he or she have?

Answer. All Brilliant Pebbles will be under the continuous positive control of human decision makers at all times. The human control will decide on alert level changes, self-protection countermeasures enablement and weapon release, strategy/tactics selection, and direction of reconstitution.

In tension and crisis situations, the decision maker may face decisions to elevate the alert status of SDS elements. Such steps would lead to further decisions possibly concerning engagement enablement. The times for such decisions are expected to be measured in hours to days and will permit full coordination with higher authorities and other unified and specified commands.

With intelligence warning of imminent attack or with only real-time tactical warning of a surprise attack, the decision maker must decide to enable capabilities not previously enabled, release countermeasure actions, and grant weapons release authority.

Question. How will the commander be able to intervene in the autonomous response to an attack during an engagement?

Answer. Human in-the-loop is the basic premise of the Brilliant Pebble command and control structure. For an intercept to occur, the human in-the-loop must provide two key controls: (1) weapon enablement and (2) weapon release authority.

The high-level command and control structure for elements of the SDS Phase I, including Brilliant Pebbles, is being planned in coordination with U.S. Space Command (USSPACECOM). As currently envisioned with the Lawrence Livermore National Laboratory design, the most obvious intervention form of positive control is termination of engagement actions. This is planned by dissemination of a change message directing standdown from Battle ready to an Alert state, thereby in effect retracting the previously granted weapon release authority. If desired, this can be followed by a separate message which causes disablement of engagement capabilities. Either or both of these messages could be addressed to an individual weapon, a group of weapons, an entire weapon element (e.g., the BP constellation), or all Strategic Defense System weapons.

Positive control of Strategic Defense System weapons is ensured by robust communications links and networks and by procedures, such as repeat transmission and acknowledgement of command and control messages, which guarantee message receipt, as well as by encryption and authentication methods which prevent spoofing, manipulation, and other unauthorized activity.

Question. During the past year, the SDI National Test Bed has conducted two large scale "War games" or command and control exercises, primarily to study human factors issues. These were reported to have been critiqued by general officers from the JCS, SAC, and the Army. What were their findings?

Answer. All of the wargames combined at the National Test Bed are critiqued by all participants, including general officers. The results are then incorporated into subsequent wargames as part of the ongoing development process. These findings include improvements for the displaying of critical information, ideas for examining tradeoffs of the command and control organization and process, and ideas for exploring the proper levels of human decision making.

BOOST SURVEILLANCE TRACKING SYSTEM

Question. General Monahan, if a BSTS satellite were deployed which meets the requirements set forth in the currently approved Phase I architecture, would it be in conflict with the narrow interpretation of the ABM Treaty?

Answer. All SDI field tests must be approved for ABM Treaty compliance through the DoD compliance review process. Each test or series of tests is examined on a case-by-cae basis to consider the specific test plans and the applicaiotn of the ABM Treaty to those plans. ———.

The fiscal year 1991 budget includes $265 million to begin full scale development of the Boost Surveillance and Tracking System (BSTS). If approved, this would be the first SDI program to enter full scale development.

Question. Has OSD's Treaty Compliance Guidance Group made a decision yet concerning BSTS?

Answer. Yes, ABM Treaty compliance guidance for the BSTS was signed out by the Deputy Under Secretary for Acquisition on 4 May 1990.

Question. Describe your strategy for pursuing BSTS without the hardware and software that would cause it to be non-treaty compliant. Is this verifiable? How would we react if the Soviets took a similar approach on one of their satellite systems?

Answer. Given Brilliant Pebbles, it is no longer essential that the BSTS program implement BMD mission requirements during its Block I procurement. Nevertheless, I do not want to foreclose possible future use of a subsequent block modification of BSTS as an element in BMD (e.g., providing alternate communication paths, providing second source track data, and assisting in targeting). To that end, we intend to remove the BMD requirements from the Block I procurement while maintaining options for protecting growth capabilities for subsequent blocks. The absence of BMD unique items is not likely to be verifiable by the Soviets. Because of the increasing sophistication of TW/AA satellites, the inherent verification difficulties that they pose, and the stabilizing effect of better sensor data, we have proposed to the Soviets that all ABM-Treaty restrictions be lifted from space-based sensors.

Question. Your statement indicates that BSTS in the Phase I architecture is being reassessed and may not be needed in SDI or may be needed with less capability. Why pursue it at all? What plans does the DoD have to move BSTS out of SDI funding and into the Air Force as a pure Tactical Warning/Attack Assessment System, and how would this resolve the ABM Treaty interpretation problem?

Answer. We are currently reviewing our plans for the timing of the transfer of part or all of BSTS out of SDIO.

As for why pursue BSTS at all: BSTS is crucial to resolve long standing deficiencies in Tactical Warning/Attack Assessment and several other missions. As the follow-on to DSP, BSTS is necessary in order to satisfy validated TW/AA requirements ———.

Application of today's state-of-the-art technology frees the early warning system from overseas bases, requires fewer personnel to operate, provides more detailed information to using commanders, and has a lower life-cycle cost.

Question. Does BSTS have the following normal documentation for DoD weapon systems: approved Statement of Requirements Document; a DIA-validated threat document (to determine system survivability requirements); a System Requirements Review (to determine the limits of technology on performance); and a Test and Evaluation Master Plan?

Answer. The BSTS has a USCINCSPACE approved System Operational Requirements Document. The BSTS has been referencing the DIA validated threat document for the SDS; the BSTS-specific STAR is in development and validation is expected this summer in time to support the Milestone II DAB review. BSTS has had several system requirements reviews: in 1984 during requirements definition phase of their contracts, in 1986 prior to entry into demonstration/validation, in 1988 during the dem/val interim design review, and currently the system program office is conducting a final design review which is assessing this issue. The current BSTS TEMP is approved and it too will be updated prior to Milestone II.

Question. What is your assessment of the technical risk of BSTS development, and what are the highest risk elements?

Answer. The technical risk of BSTS development is currently rated as medium to high. The major risk areas are: radiation hardened, qualified, high-speed, low-power signal processing chips and producible focal plane arrays. More distant risk areas are aspheric mirrors and background phenomenology.

Question. What is the total full scale development cost of BSTS in then year dollars?

Answer. We are currently projecting $6,347 million.

Question. Discuss the redundancy that BSTS in SDI may provide, and conversely, the number of additional "brilliant pebbles" that might be needed if there were no BSTS.

Answer. BSTS could provide alternate communications paths for command and control data between Brilliant Pebbles and the Command Center; second course track data through the use of a different set of sensors and viewing geometry; and assist in targeting ———. We have not completed all of the engineering trades to evaluate all of the various architectures that might be fielded in support of a Brilliant Pebbles.

Question. How much has been invested in BSTS development to date?

Answer. A little over a billion dollars counting direct funding and an allocation of a portion of our technology development efforts to BSTS.

Question. How much would be saved in the SDS Phase I architecture if BSTS were not pursued?

Answer. Up to now we have shown the total amount of the BSTS cost charged to the SDS Phase I cost. Not accounting for the TW/AA cost would reduce the SDS Phase I chargeable cost to $47 billion (from $55B). In addition, $2 billion which would be used for launch costs for the BSTS satellite is to be held in reserve against possible modifications to the architecture to accommodate the removal of BSTS.

Question. The committee understands that DoD policy requires that the elements of SDI Phase II must gain demonstration/validation (Milestone II) approval from the Secretary of Defense before any of the Phase I systems can proceed into full scale development. Is this still accurate, and if so, why is BSTS failing to comply with this requirement?

Answer. The Department of Defense is presently reviewing the acquisition process (Defense Acquisition Board process) as it applies to the SDI program. It is premature to speculate on the outcome of that review.

Question. What are the acquistion milestones for BSTS?

Answer. Milestone II—October 1990; Start of Full Scale Development—March 1991; Preliminary Design Review—March 1992; Critical Design Review—March 1993; Milestone III—August 1993 (post CDR); ———.

THEATER DEFENSE

Question. As part of its overall mission, SDI funds a program to defeat tactical ballistic missiles. Included in this effort is the joint U.S.-Israeli development of the Arrow missile. General Monahan, what is SDI's overall fiscal year 1991 budget request for Anti-tactical Ballistic Missile programs, and how does that compare to last year's budget?

Answer. The FY 1991 program for theater defense (Anti-tactical ballistic missile defense) is $143.6 million while the FY 1990 program was $129.1 million. The principal increase was in the allocation for the Extended Air Defense test bed. This FY 1991 program includes funds to complete an initial Arrow flight demonstration (3 experiments).

Question. General Monahan, last year, you testified that the fiscal year 1990 SDI budget request in theater defense reflected a change in philosophy from analysis to technology experiments. Is that still your plan for 1990 and 1991?

Answer. That is the case insofar as architecture studies is concerned. The Western Pacific Architecture Analysis is the last of a series of analytical studies of missile defense needs and it will be completed in February 1991. The FY 1990 and 1991 programs support experiments, interceptor development, and test bed development programs. Other analyses will also continue, however, such as the systems engineering and analyses planned for the US/UK and US/Israeli program and continuing studies of the threat and its permutations in today's environment.

Question. General Monahan, how much is budgeted in fiscal year 1991 for theater defense and how will these funds be used?

Answer. The FY 1991 Theater Missile Defense Program is currently allocated $143.6 million. These funds will support the following programs.

Theater Missile Defense Technology experiments—(Five low level experiments in sensor/seeker technology).

Theater application of Hypervelocity gun technology (upgrade of HVG technology to propel a 100mm diameter projectile to velocities up to 2.5km/sec).

Missile interceptor programs.

—Completion design and fabrication of ERINT-1 components.

—Completion of Arrow flight tests and analysis.

—Completion of THAAD concept design.

Theater Test Beds. Completion of design parameters and initial installation at the U.S. base node, and the development of common threat simulations for the Extended Air Defense Test Bed. Continued development of the UK and Israeli test bed programs.

Other theater defense programs to include cooperative efforts such as:

—Application of Artificial Intelligence and knowledge based systems in battle management.

—Use of Directed Energy in theater application.

—Theater Defense Systems Engineering and support.

—Lethality research and low level experiments.

Question. General Monahan, what is the status of the Arrow program? How much is budgeted in fiscal year 1991? What activities are planned? Has the U.S. or Israel yet decided to make Arrow more than just a missile technology experiment, i.e., to commit to developing the radar and battle management supporting systems? What are the program milestones? What is your program objective or goal for Arrow?

Answer. ———.

ANTI-SATELLITE PROGRAM

Question. The Army has been designated to be the lead service for development of the kinetic ASAT, a high-speed ground-based missile to hit low altitude satellites. The Army and the Air Force are also working on directed energy concepts to meet long-term ——— ASAT requirements, and at a future time OSD will select one of these approaches for further development.

General Monahan, what is SDI's role in the Army's near term kinetic ASAT program?

Answer. While certain technologies developed under the SDIO kinetic energy interceptor programs are applicable to the KE ASAT mission, the Army Joint Program Office is developing a separate and distinct system, with funds which are not from SDIO. The DAB reviewed and endorsed this approach, and this review was reflected in documentation sent earlier this year to the Congress.

Question. What is SDI's role in the "competition" between the Services for the longer term directed energy ASAT weapon?

Answer. After initial studies indicated that the Free Electron Laser (FEL) has technical merit as an ASAT weapon, the DAB implementor for the ASAT Milestone O directed that the Army begin the adaptation of the technology developed under the SDIO FEL program to the ASAT mission. This task was begun in FY 1990, under Army funding separate from SDIO. The Army Ground Based Laser Project Office has initiated accounting procedures which ensure that ASAT tasks are supported by ASAT funds. SDIO has had no involvement in the development of the other laser ASAT candidates being studied by the Air Force.

Question. What are the inherent capabilities of SDI funded programs to be ASAT's or to assist in targeting? Address: "Brilliant Pebbles", ERIS (Exoatmospheric Reentry Vehicle Intercepter Subsystem), Directed energy weapons, BSTS and SSTS.

Answer. While there are technical similarities between the ASAT and SDI weapon systems, the policies underlying these two programs are quite different. Current SDIO research efforts attempt to provide the data necessary to support an informed decision whether to proceed with further development and deployment of a Strategic Defense System. The Department would be remiss in the current budget environment if we did not fully utilize those research efforts wherever they might be applicable (whether for ASAT or other defense programs), leveraging the substantial investment made by SDIO to date.

Question. Are any of SDI's fiscal year 1991 funds considered to be for ASAT purposes? If so, how much?

Answer. No fiscal year 1991 funds have been requested by the SDIO for ASAT purposes.

Question. Are any of SDI's fiscal year 1991 funds considered to be dual use programs? If so, what instructions have been given to program managers concerning dual use for ASAT programs?

Answer. SDIO does not consider any of its programs to be "dual use" in any formal sense. At the same time it should be noted that SDIO is developing technologies in both Kinetic Energy and Directed Energy areas that have ASAT potential or applicability.

SDIO program managers have been instructed to plan and conduct their programs with the mission of ballistic missile defense as the sole basis for allocation of resources.

Question. How are SDI programs that are the basis for the Services' ASAT development programs coordinated with the Services and OSD?

Answer. Of present SDIO programs, only the FEL program can be considered the basis for an ASAT development program, as directed by the DAB implementor of 6 March 1989. It is the Army's responsibility to coordinate the distinct SDIO and ASAT FEL programs. SDIO maintains its focus on those issues required by Ballistic Missile Defense applications of ground based laser systems.

INDEPENDENT REVIEW

Question. The Presidential Directive required an independent review of the current SDI program and its priorities, to be accomplished by September 15, 1989. Was the review accomplished, and if so what were the major findings?

Answer. As was indicated in testimony, Ambassador Henry Cooper has recently completed an independent review for the Secretary of Defense. The Secretary is presently reviewing the recommendations from the "Cooper Study". The results of any decisions taken from that consideration will be communicated to Congress in a timely manner.

Question. What changes were made to the SDI program as a result?

Answer. As noted previously, Ambassador Henry Cooper has recently completed an independent review of the SDI program for the Secretary of Defense. The Secretary is presently reviewing the recommendations from the "Cooper Study." The results of any decisions taken from that consideration will be communicated to Congress in a timely manner.

Question. Your statement indicates that during the past year reviews of "Brilliant Pebbles" by the DoD Space-based Architecture Study Group, the JASONs panel of scientists, and the Defense Science Board were made. Please discuss in detail the major findings of each.

For the record, provide each report (or executive summaries if the reports are lengthy).

Answer. The Space-Based Architecture Study Group, the JASONs and the Defense Science Board reviews found the BP concept to be capable, innovative and without any critical flaws. They also cited that certain critical issues, needing resolution, could be resolved over the next few years through a sustained and strong research and development program.

The Space-Based Architecture Study focused on alternative space-based weapon options. The study concluded that a distributed and autonomous concept holds promise for cost savings.

The JASONs review of the Brilliant Pebbles concept emphasized technical feasibility of the component technologies and suggested increased emphasis on countermeasures. No technical show-stoppers were found. The panel "endorsed further research on the concept of proliferated small, lightweight, smart interceptors for Ballistic Missile Defense and Other Missions." The JASONs recommended further integration of promising SDI technologies to improve system performance and robustness. In addition, the panel highlighted issues to be resolved with near-term analysis and laboratory tests.

The Defense Science Board (DSB) also found "no fundamental flaws identified in the Brilliant Pebbles Concept." The Defense Science Board recommended that the development of the Brilliant Pebbles concept be continued along with the evaluation of the full impact of Brilliant Pebbles concepts and approach on other elements of the ballistic missile defense.

Question. The Committee understands that Defense Acquisition Board (DAB) reviews of SDI were to occur yearly to ensure goals were being met and to assess any major changes to the baseline. Explain why "brilliant pebbles" has not yet been formally approved by the DAB? When was the last SDI DAB? When are additional DAB reviews now scheduled?

Answer. Brilliant Pebbles was originally scheduled to be reviewed by the Defense Acquisition Board (DAB) on December 11, 1989, following a review by the supporting Strategic Systems Committee (SSC) on November 27, 1989. The SSC review was completed. A DAB review was judged unnecessary as the streamlined acquisition approach adopted for Brilliant Pebbles could be executed within existing program funding and schedule constraints.

The last SDI DAB occurred on October 8, 1988. Currently, the DAB will review Brilliant Pebbles and overall management of the

Strategic Defense System (SDS) on June 14, 1990, with a full annual review in planning for the Spring 1991 timeframe.

SDIO'S MISSION

Question. A December 1989 Defense Science Board report on Brilliant Pebbles states: "The SDI program appears to suffer from a conflict of purpose. At times the program has emphasized research on new and better technologies and concepts. At other times it has emphasized deployment of a system. These two aims are in competition . . . There is not now a clear direction to SDIO about which of these objectives they are supposed to pursue and if both, as seems likely, the relative emphasis on the two. We therefore urge that the Secretary of Defense make the relative balance between exploration and building clear to the Director, SDIO, so that his limited resources can be properly employed."

General Monahan, at this late date why is there confusion about SDIO's mission?

Answer. I would hope that no confusion exists. SDIO's mission has been fully consistent since its inception in 1985. SDIO's mission is documented in Department of Defense Directive 4141.5, dated 4 June 1987, as follows:

SDIO shall manage and direct the conduct of a vigorous research program, including advanced technologies, that will provide the basis for an informed decision regarding the feasibility of eliminating the threat posed by nuclear ballistic missiles of all ranges, and of increasing the contribution of defensive systems to U.S. and allied security. The program shall protect options for near-term deployment of limited ballistic missile defense. The program shall be carried out in full consultation and, where appropriate, with participation of our allies. The program shall be conducted in compliance with all existing treaty obligations and will emphasize nonnuclear technologies.

It is my policy to conduct a balanced program to accomplish all aspects of this mission. From time to time, as one or another accomplishment or issue receives or requires special attention, it may appear as if we are emphasizing one aspect of our mission or another. All, however, are a part of SDIO's effort to provide in-depth research and analysis required for the President to make an informed decision on the deployment of strategic defenses. The SDI program is a continuum of opportunities, both to achieve near-term capabilities and to work for longer-term improved capabilities, and we are pursuing them all within our mission statement and as resources permit.

Question. What guidance do you have from the Secretary of Defense in this regard?

Answer. The Secretary of Defense's guidance is a reflection of the views of the President. Upon taking office, President Bush called for a comprehensive review of our national security strategy and objectives. Based on that review, he issued the following assessment and direction:

The goals of SDI remain sound. In pursuing SDI, we seek to maintain the strategic balance and place deterrence on a more stable basis.

The SDI program will be structured to enable the President to make an informed decision on deployment of strategic defenses within the next three years. It will continue to pursue options for layered defenses, composed of both ground- and space-based elements. It should remain flexible and continue toward deployment of a system to meet Phase I requirements by focusing on the potential of the most rapidly advancing technologies (such as Brilliant Pebbles).

The SDI program will be conducted in full compliance with all our international obligations.

Question. What does the Secretary of Defense plan to do about the Defense Science Board's recommendations?

Answer. The Secretary of Defense has repeatedly laid out, in public speeches, in appearances before Congress, and in other fora, U.S. policy on this subject. He has continued to express strong support for the SDI program. The Department continues to believe U.S. national security would be enhanced by the deployment of effective strategic defenses against ballistic missiles.

DEPLOYMENT CRITERIA

Question. A recent study by the Center for International Security Studies at the University of Maryland discusses SDI deployment options. It says:

"While many have debated the goal of strategic defenses, few have explicitly discussed the criteria that a (SDI) defense system must meet. This lack of discussion can be attributed to the general acceptance of the so-called 'Nitze criteria', which state that strategic defenses should be militarily effective, survivable, and cost-effective at the margin . . . Despite agreement that the Nitze criteria should govern a deployment decision, they form an insufficient basis for such a decision . . . It is therefore necessary to develop a set of criteria for strategic defense options that are more encompassing than the Nitze criteria. Such criteria should include strategic, technical and economic considerations which respectively determine the desirability, feasibility, and affordability of strategic defense deployment options."

General Monahan, what are the specific criteria that you are working against to provide SDI deployment options to the President in three years?

Answer. The President can make a deployment decision without regard to any formal DoD acquisition milestone criteria; however, we expect that technical issues will be among the many considered by the President when making his decision. SDIO's job, in regard to the President's decision, is to objectively present the technical potential and possible risks. Phase I of the Strategic Defense System is currently in the Demonstration/Validation phase of the DoD acquisition process, and our next milestone (Milestone II) will permit us to enter the Full Scale Development (FSD) phase. The detailed list of technical criteria necessary to demonstrate and validate the Phase I system, which expands beyond the Nitze criteria, has not been agreed to. The list will include assessments of the system's ability to meet the user's requirements and perform key system functions. The objective of the acquisition process, and the associated technical criteria, is to insure that risks are continually being reduced as more resources are committed. Consequently, the results of the acquisition assessments will be one input to a Presidential decision.

Question. Do you in fact have more detailed criteria than the Nitze criteria? If not, do you think they are needed?

Answer. Specific criteria are still being worked out internally and with the Office of the Secretary of Defense which will be used to evaluate specific technical issues.

Question. The study suggests that cost effectiveness in relation to alternatives is important. It says the economic affordability of any strategic defense will depend on whether there are alternative measures that can achieve the same strategic objectives at less cost. Do you agree?

Answer. Only under very limited conditions. The three options to counter the ballistic missile threat are deterrence, diplomacy, and destruction of missiles with active defenses. We have chosen in the past to rely on deterrence and diplomacy. Active defenses can both enhance the deterrent posture, and provide protection should deterrence and diplomacy fail. If adversaries will not be deterred by our offensive forces, a probable case with third world threats, then the value of defense is independent of the offensive force. The technologies we are pursuing in SDIO can address both enhancement of the deterrent posture and protection should deterrence fail.

Question. Is "deterrence" the strategic objective of SDI?

Answer. The strategic objective of SDI is straightforward—to eliminate the threat posed by ballistic missiles. Achieving this goal involves the phased deployment of strategic defenses to both enhance deterrence by creating uncertainty in the mind of an attacker and to provide the ability to protect valuable targets, areas, and interests of the United States should deterrence fail. The enhancement of deterrence is a primary goal of the Phase I Strategic Defense System. It will also allow us to protect valuable targets against accidental or unauthorized launches, attacks by third parties, or limited attacks by the Soviet Union. Follow-on phases will provide increasing capability to deny the military utility of a ballistic missile attack and provide increasing levels of protection to targets of value in the United States and abroad. Ultimately, the SDI program and a deployed Strategic Defense System should lead to a defense-dominant strategic environment in which ballistic missiles would become, in the words of former President Reagan, "impotent and obsolete".

Question. The study suggests that the alternative to active defenses is to enhance ICBM survivability, the primary means of doing so being to deploy the Small ICBM on hard mobile launchers. The study suggests that deployment of the SICBM could ensure more surviving warheads at relatively less cost than a strategic defense. Do you disagree?

Answer. The United States continues to believe modernization of our strategic offensive forces, together with the development and deployment of strategic defenses and arms control can enhance deterrence, increase strategic stability and bolster U.S. and Allied security.

Question. As is normal for decision making for all DOD weapon system acquisitions, what analysis has SDIO made of the costs of alternatives to SDI?

Answer. As new technologies become available, tradeoff studies are conducted to determine the most cost effective means of acquiring an SDS. Studies such as the recent Space Based Architecture Study (SBAS) are conducted to ensure that all possible (technological and cost effective) alternatives are considered throughout the SDI evolutionary process.

Question. For the record, please provide a cost comparison between SDS Phase I and deployment of Small ICBM force in terms of survivable warheads after a first strike attack. Please enumerate and explain assumptions behind the analysis.

Answer. The SDS Phase I system and the Small ICBM were designed to perform significantly different missions, therefore it is inappropriate to provide a cost comparison since survivable warheads is not the primary metric by which an SDS Phase I is to be judged. However, SDS is designed to provide protection for a wide range of assets, not only ICBMs. Other elements of the U.S. strategic forces, tactical forces, national leadership and economic centers could be protected as well. A study focused on warhead survivability will not reflect the reality of how SDS could be employed.

The following issues must be kept in mind:

(1) SDS and the Small ICBM are both designed to enhance deterrence but in significantly different ways. An active strategic defense is designed to influence Soviet decision making by diminishing their confidence in the ability to achieve first strike objectives against all targets, which may include U.S. retaliatory forces. The Small ICBM, on the other hand, is designed solely to negate Soviet efforts to neutralize U.S. forces and increase the endurance of U.S. retaliatory capability by ensuring the survivability of warheads.

(2) Strategic defenses are designed to limit damage. Small ICBMs, however, are designed to ensure retaliatory damage against the USSR.

(3) In addition, strategic defenses are designed to shift the basis of deterrence from one based upon the threat of inflicting retaliatory damage to one based upon greater reliance on the ability to defend against ballistic missile attacks. The value of accomplishing this change in strategic policy cannot be captured in a cost comparison focused on the number of surviving warheads.

TESTS AND EXPERIMENTS

Question. The fiscal year 1991 budget indicates that 16 major SDI tests and experiments are planned.

General Monahan, in layman's terms please describe the activities that are planned next year and the objectives these tests will accomplish.

Answer. The 16 Major Accomplishments identified in the SDIO FY 1991 Presidential Budget Submission are to be attained through a corresponding series of tests and experiments designed to expand scientific data in specific areas of technology critical to the development of a Strategic Defense System. The objectives for each of the 16 tests are characterized below. Since submission of the President's Budget, the schedule for one experiment, Bow Shock, was accelerated and completed in FY 1990. Four other planned tests have been delayed into FY 1992 because of changed funding or test program priorities.

Brilliant Pebbles Flight Test 6 (Brilliant Pebbles First Intercept) will demonstrate the intercept of a solid, thrusting target traveling with representative velocity and intercept geometry. This suborbital test will demonstrate the capability of a mission capable vehicle to acquire, track, and collide with a solid target.

Brilliant Pebbles Flight Test 9 and 10 (BP Lifejacket/Comm Demo In Space) will launch two Brilliant Pebbles life jacket/sensor packages into low earth orbit. There the satellites will demonstrate communication, orbital maintenance and station keeping, earth event observation (simulated launches), built-in-test capabilities, and operation of the life jacket.

Starlab (Track & Point Laser in Space At Thrusting Missiles): Originally scheduled for launch aboard the Space Shuttle in FY 1991, Starlab has been delayed into FY 1992 because of funding and programmatic developments. The experiment will demonstrate acquisition, tracking and pointing technology needed to use directed energy or neutral particle beams in space, improve basic knowledge of target missile plumes and signatures, and test concepts in a realistic environment. During the 7-day mission, Starlab will acquire and track 5 Starbird missiles to gather plume phenomenology and background measurements, and obtain related optics data. A developmental test of the four-stage solid fuel Starbird booster is scheduled during late FY 1991.

LPX (Liquid Plume Signature Data Collection): This experiment will fly in conjunction with the Starlab Space Shuttle mission in FY 1992 to observe atmospheric interaction with liquid target plumes, especially sensitive regions of the flow field, and collect multispectral target signature data during the boost phase. The LPX target missile will be launched from Wake Island during an overpass of Starlab. A developmental flight test of the LPX missile is scheduled for June 1991.

AOA/AST (First Airborne Optical Adjunct/Airborne Surveillance Testbed Flight Test): A Boeing 767 has been modified to carry an airborne sensor to collect baseline infrared signature data for surveillance, acquisition, tracking and discrimination of reentry vehicles. Initial flights will test development and integration of the aircraft, advanced infrared sensor, and associated communication systems. The testbed will fly 8 missions from Kwajalein Atoll in FY 1991 to check out the sensor system and collect tracking and signature data of ballistic reentry targets.

IBSS (IR Measurement of Plumes & Earth Clutter From Space): The Infrared Background Signature Survey (IBSS) package will fly on the same Space Shuttle Mission with CIRRIS. Scheduled launch is in January 1991. IBSS will measure the infrared spectrum and spatial dispersions of exhaust plumes and clouds released from the Shuttle and three other test satellites deployed from the Shuttle. Measurements will be used to assess impacts on sensor performance and development.

CIRRIS (IR Emissions of Earth Limb From Space): The Cryogenic Infrared Radiance Instrumentation for the Shuttle (CIRRIS) experiment, to be flown on the Shuttle with other experiments, will collect infrared emissions data of the earthlimb (earth's atmosphere as viewed from space). This data will assist development of the capability to detect cold body targets against an earthlimb background.

LIFE (LEAP First Flight Test): A Lightweight ExoAtmospheric Projectile (LEAP) developed by Boeing will be launched from White Sands Missile Range on a suborbital trajectory to a maximum altitude of 180 km as part of the Air Force LEAP Integrated Flight Experiment (LIFE). The main objectives of the flight are to validate the projectile's flight characteristics outside the atmosphere, collect high resolution sensor data against the earth, earthlimb, and space backgrounds, and track a hot infrared point source using LEAP.

ALIVE (LEAP First Intercept): The Army LEAP Integrated Validation Experiment (ALIVE) is planned as an intercept of a cold body target by a LEAP vehicle developed by Hughes Aircraft Company. Both the LEAP vehicle and its target will be launched by the same booster on soborbital trajectories from White Sands Missile Range. The subsequent engagement will result in the LEAP acquiring the target at about 15 km separation with the two vehicles closing at moderate relative velocity of about .8 km/sec.

FIREBIRD (PBV/Decoys Measurements): The Firepond ground based laser radar facility at the MIT/Lincoln Laboratory near Boston, MA, will observe the deployment of a number of objects ———. Firefly verified the ability of laser radars to image objects the size of reentry vehicles at very long range and with very high distance and velocity resolution.

BOW SHOCK (Ultraviolet Measurements), successfully launched on April 24, 1990, was a $2 million test to measure ultraviolet radiation emanating from the nose of a boosting missile in the atmosphere. A suborbital rocket was launched from NASA's Wallops Island facility and attained a velocity of more than 3.5 km/sec. Onboard sensors measured the radiation emission from the superheated air in the vicinity of the nose cone and found the emissions more intense than predicted. The experiment affirmed that ultraviolet signatures could be measured from fast-burn type boosters and rapid anti-satellite missiles in the atmosphere, even after the missiles' main engines have shut down. This capability precludes an adversary from avoiding detection by using fast-burn missiles not readily detected by other types of surveillance sensors.

ARROW (First Flight Test): The three flight tests of the Israeli Arrow interceptor missile are scheduled for FY 1991. The tests will determine the missile's capability at ——— Arrow's warhead will also be evaluated.

ERINT (First Flight Test): Funding considerations have required the first test flight of the Extended Range Intercept Technology vehicle to be delayed into FY 1992. ———.

GTA-24 (First Mid-Power Ground Demonstration of a Neutral Particle Beam (NPB)): GTA-24 will be the first demonstration of integrated NPB accelerator and beam control systems at power levels that can be scaled up to levels needed for weapons application. Funding changes have delayed this demonstration until FY 1992. $45 million are programmed for GTA-24 in FY 1991.

SRMP (Midcourse Target Measurements): Four Sounding Rocket Measurements Program (SRMP) missions are scheduled in FY 1991 ———.

HAP (High Power FEL Demonstration): The High Average Power (HAP) experiment at Boeing in FY 1991 will demonstrate the basic physics and laser configuration that will be used in the Ground-Based Free Electron Laser Technology Integration Experiment (GBL/FEL-TIE) at White Sands Missile Range in FY 1994.

Question. What are the total estimated SDI costs for these 16 experiments?

Provide the amount for each test for the record.

Answer. Estimated costs for the major experiments presently scheduled for FY 1991 are tabulated below. For the Arrow, IBSS and CIRRIS tests, where all test activity of that program will be conducted in FY 1991, the figures reflect the total multi-year costs of that program. For the rest of the experiment programs that encompass test activity in other years, the figures represent only the costs and investments directly associated with the planned FY 1991 activities. Costs include acquisition of expendable test items and unique test capabilities, supporting range and laboratory facilities, and data analysis.

Experiment: BRILLIANT PEBBLES:	*Millions*
FT-6	$55.0
FT-9&10	85.0
STARBIRD flight test	4.5
LPX missile development test	11.4
AOA/AST, 8 airborne tests	64.1
IBSS	88.7
CIRRIS	95.0
LIFE	3.0
ALIVE	4.2
FIREBIRD	5.0
ARROW, 3 flights tests	158.0
SRMP	10.0
HAP	40.0
Total	623.9

Question. A November 1989 letter to you from Lt. Gen. Hammond (Commander of the Army's Strategic Defense Command in Huntsville, Alabama) states: "A general observation: It appears that we are about to convert a large part of our collective, joint, coherent effort into a hobby shop, heavy on space-based experiments—experiments that in the past have yielded little value relative to the huge investment costs and are of such significant risk that they promise relatively little value in the future. Many of these programs are being continued or plussed-up in these times of constrained resources even though they are duplicative * * *" How did you respond to the General? What changes have you made in your 1991 space based experiments as a result of his well intended criticism?

Answer. There was no written response. General Hammond's letter was an input to the intense budget exercise that was being conducted to reduce the FY 90 program from the $4.6 billion Presidential request to the $3.57 billion congressional appropriation.

The 1991 space-based experiments, as well as all other 1991 activities, are structured in accordance with Presidential guidance.

Every experiment was scrutinized and evaluated with regard to its value and necessity in accomplishing Presidential directives. Some, such as the FEL beam director, were terminated. Others were cut back.

Question. Does the fiscal year 1991 SDI budget request funds for any tests, experiments, or other activities that are not in full accord with the ABM treaty?

Answer. The fiscal year 1991 SDI budget requests funds only for tests, experiments, and other activities that are in full accord with the ABM Treaty.

SOFTWARE

Question. AT&T's telephone system has been cited as evidence that complex computer systems can be virtually flawless. However, it is not as complex as SDI and has far less rigorous security requirements. On January 1990, the AT&T network failed in spite of being well understood and well tested. Critics of SDI say we can have high confidence in the telephone system's software because it is constantly being evaluated under conditions of actual use, but this would never be possible for the software in SDI. How do you respond?

Answer. This question is relevant to many of our weapon systems in use today. We are partitioning the system so that each component can be individually tested and then integrated with other components and retested. Using this approach, we can build sufficient confidence that the system will perform as desired when necessary. This is the same problem that was faced by the Manned Space Program. Their software was tested as components and retested when integrated together in a non-operational environment; and, operated as planned when implemented in an operational environment.

Question. Given a complex ground and space based network in SDI, how will software errors be discovered, corrected and tested?

Answer. The SDS will be in continuous evaluation in peacetime exercises and continuous self-checks, errors can be uncovered and corrected. Block software upgrades will also offer opportunity to check performance. This process is similar to the operations at NORAD, where they continuously update their system, even though they are operational.

SDS software will be developed by building and testing a series of incremental prototypes. In development, SDS elements will be integrated and tested through system simulations of increasing fidelity and resolution.

Question. If the system software is being built by many vendors, how are you ensuring that consistent software development and testing techniques are being used?

Answer. Consistent software development and testing is being addressed by applying software engineering disciplines and methodologies across the developers of the system. The adherence to MIL-standards such as 2167A, system level interfaces, and the Ada programming language, provide the necessary structure to ensure consistent development of the software.

The SDIO is establishing a Software Development Program and is developing a standard Software Engineering Environment and a Software Center to integrate multiple SDS developers. System simulations and testbeds are planned that will evaluate software integration and consistency.

Question. What actions are being taken by SDI to ensure there are sufficient numbers of software experts in place to meet program goals which require engineering support to a network of hundreds of processors and tens of millions of lines of software code?

Answer. The Institute of Electrical and Electronic Engineers held a conference this past February on Strategic Software Development. This conference was designed to inform the software community of the challenges faced by the SDS. This conference and others like it are one method being taken by the SDIO to ensure that the software community is aware of the SDS issues and provides useful feedback on various approaches to resolving those issues.

Question. How will sufficient security be built into SDI hardware (for fault tolerance) and into the software (for information security)?

Answer. A highly distributed architecture of space and ground platforms is quite robust from a system point of view and is designed to be tolerant of single failures. As with many DoD systems, developers of SDI are drawing heavily on the technical expertise of the National Security Agency (NSA) in defining and applying security techniques to ensure the integrity of the system.

Question. How will you ensure that the synchronization problem for all the SDI computer data bases is resolved prior to entering a full scale development decision for major SDI components?

Answer. The current SDS architecture affords a high degree of autonomous operation from a data standpoint and reduces the former stringent synchronization requirements on the databases. The remaining synchronization issues will be addressed by the National Test Bed (NTB), which is a nationally distributed test bed comprised of multiple elements located across the country.

COMMUNICATIONS

Question. Before committing to deployment of a proliferated, space-based Phase I system, a number of technologies need to be demonstrated for communications between satellites at different altitudes in a highly dynamic network environment. What are the communications problems that need to be solved for a "Brilliant Pebbles" system involving communications between thousands of objects—all in different orbits—and their ground stations?

Answer. The techniques supporting Brilliant Pebbles communication is similar to that employed for cellular phones. Communications technology is in hand to support flood routing and trellis network schemes for communication throughout the Brilliant Pebbles constellation.

Existing systems have achieved required high data rate communications. Brilliant Pebbles low data rate requirement alleviates many of the issues associated with current systems. The challenge for Brilliant Pebbles communication is a need for transmitter and receiver subsystems to have low mass, small size, and reasonable power consumptions, but still support communications link distances of several thousands kilometers. These engineering and integration issues will be investigated in detail by the Concept Definition contractor teams. These mass and power requirements, along with needs to operate in hostile communications environments, make use of short wavelengths and narrow, high-gain transmit beamwidths very attractive. Laser communications easily satisfies these criteria with small, light components and inherently narrow beamwidths. Extremely High Frequency technology could also provide sufficiently narrow beams with practical antenna sizes.

Question. Are there "off-the-shelf" communications technologies available today for both laser and EHF satellite communications?

Can existing technologies provide transmission rates sufficient for SDI purposes?

Answer. Yes, all of the Phase I SDS communications requirements can be satisfied with laser or Extremely High Frequency technologies. Laser communications (LASERCOM) technology is not new. The understanding of its physics, the definition and analysis of waveforms has been known for some time. However, more recent advances have made LASERCOM practical. Among these advances is the development of efficient, high-power, stable laser diode phased arrays for pumping lasers.

While lasercom technology is currently off-the-shelf, there still are challenges in packaging for specific applications of relevance to SDI. For example, an important aspect of the Brilliant Pebbles application is the need for low mass and effective thermal management of the laser transmitter assembly to accommodate the Brilliant Pebble communications. ———. Crosslinks of SDS satellites in medium to high earth orbits will also have their own unique packaging requirements.

Extremely High Frequency communications are more mature. Extremely High Frequency is very promising for transatmospheric up and downlinks, as well as wide-angle space-to-space broadcast type links. Current Extremely High Frequency technology is also considered an alternative for non-agile satellite crosslinks with data rates up to several hundred million bits per second.

Question. Approximately how many space objects are active today and controlled by U.S. ground Stations?

How does this compare to the number of objects in space under SDI Phase I?

Answer. Approximately 150 U.S. satellites are controlled by U.S. networks of some kind. This approximation includes commercial, military, and NASA satellites. A more precise answer is available from Air Force Space Command.

If we assume a Brilliant Pebbles-based architecture for a Phase I SDS, the number of objects in space could be increased by 4,000 to 5,000, depending upon the final architecture configuration. However, the mere number of objects in space does not convey the real issues, as the Brilliant Pebbles concept requires relatively little communication between space objects, and between space objects and ground facilities. The real issues involve battle management and command and control concepts, with communication links to support and network the required functions. These issues are being studied to assure that, whatever space architecture may be chosen, the resulting system and its requisite number of space objects will be controlled effectively and will be within the overall space environment projected during its potential deployment and operation period. The SDS will only affect those communication elements with which SDS elements interact; other satellite communication systems, such as commercial communications satellite ground links, will not be impacted.

Question. How do you plan to obtain command, control, health, status, and orbital retention of the thousands of objects in space in the "Brilliant Pebbles" concept?

Will the requirements be placed on the Air Force Satellite Control Network, and if so, how?

Answer. The current Brilliant Pebbles concept brings its own communications network and should not require extensive augmentation of the Air Force Satellite Control Network. The Brilliant Pebble constellation flies flight paths as directed through the Brillian Pebble Element Control Center/Element Operations Center (ECC/EOC). Each Brilliant Pebble will maintain its own status and report this on a periodic basis.

Question. Discuss in detail for the record the limitations of laser communications technology today and the implications for its use in SDI. What alternative technologies are being examined?

Answer. Current laser communications technology has limitations in three primary areas: power sources; pointing, acquisition and tracking of narrow laser beams; and detector technology for multiple channel communications. Most research for high power output has been in the area of gas laser; for size, weight, and reliability reasons, solid state sources at powers up to 5–10 watts are needed for space communications. Nd:YAG lasers are able to achieve these output levels, but their efficiency is low. To meet the required efficiency and reliability, laser diodes and diode arrays are being developed. Pointing, acquisition and tracking (PAT) are problems in laser communications because the beamwidth of the laser beam can be hundreds of times smaller than the beamwidth in a Radio Frequency (RF) system. Laser communications systems need either very accurate information on the position of the remote terminal, or a feedback link to maintain beam pointing toward the remote terminal.

Laser communications offers positive implications for space communications. The short wavelengths will inherently allow smaller and lighter components to be developed. Short wavelengths also mean that large amounts of gain are available from very small antenna apertures, which causes the size of antennas to be greatly reduced as compared to RF systems. This in turn allows links to be closed with less power output than in RF systems, yielding less drain on the spacecraft's prime power supply. Laser communications, because of the narrow beamwidths, are very jam resistant. The high frequency of laser radiation also means that more bandwidth is available to transfer information. Finally, the short wavelength allows optics to focus multiple beams independently on to one detector array, thereby facilitating simultaneous reception from several sources.

Radio frequency technology is more mature, and components are under development in the EHF region (20, 44, 60 GHZ), which offer reduced size, smaller antenna apertures, and lower power requirements compared to lower frequencies. Advanced Solid State power amplifiers, transmitters, receivers, and antennas are under development for integration into a more capable RF system.

SPACE POWER

Question. Five years ago, development of an SP-100 space power reactor and multi-megawatt power source were key SDI programs.

General Monahan, why has SDI decreased its emphasis on space power systems?

Answer. SDIO has not decreased its emphasis on space power systems. We have, however, shifted our emphasis toward lower power, near-term developments while maintaining some modest level of efforts in higher power, far-term multi-megawatt technologies. We are aggressively pursuing the development of survivable solar array power technology under a program called SUPER to provide continuous on-orbit power for our Phase I systems. This technology will likely become the industry standard for other DoD applications in the foreseeable future. We continue to be a major participant in the SP-100 Space Nuclear Reactor Power Program and are also exploring thermionics nuclear power as an alternative option. In the multi-megawatt power area, we are pursuing a number of technologies to meet the power requirements of the Neutral Particle Beam system.

Question. What plans does SDIO have to continue a ground demonstration of a 100 kilowatt SP-100 reactor?

Answer. SDIO is firmly committed to the development of the SP-100 Space Nuclear Power Program. It is a joint effort with DOE and NASA. We are currently in the Ground Engineering System demonstration phase which will culminate in a space flight demonstration in the FY 1994-95 timeframe.

Question. Why has work on multi-megawatt power systems stopped?

Answer. Work on multi-megawatt power technologies has not stopped. Due to budgetary constraints in FY90, we have reduced our effort to a sustaining level. We believe this level of effort will support the Neutral Particle Beam power system demonstration now underway.

Question. Does SDIO still have requirements for these (space power) technologies?

Answer. Yes, we need baseload power technologies like the SUPER program for both the Phase I systems and follow-on systems. The SP-100 Space Nuclear Power program is an option that we are pursuing to meet the higher power levels for continuous power. We also need the multi-megawatt power technologies to meet the burst power requirements for the Neutral Particle Beam system.

Question. What is the cost advantage of these systems over solar array power systems?

Answer. In meeting the power requirements for continuous on-orbit power at low power levels up to 30-40kw, the SP-100 is not likely to have a cost advantage. However, SP-100's unique advantage lies in its ability to provide higher continuous power levels in a compact, survivable package that is not readily obtainable with solar array systems without significant weight, volume and cost penalties. Solar array power technology cannot provide the multimegawatt burst power requirements for directed energy weapon systems because of the enormous solar array area that would be needed.

ADVANCED LAUNCH SYSTEM

Question. When Air Force Secretary Aldridge was in office, the Air Force and SDIO were keen on the need to develop an Advanced Launch System with the goal of significantly reducing space launch costs. Now that he has left, interest in this program has apparently waned.

General Monahan, please explain the current thinking on the Advanced Launch System and what has changed since the original plan?

Answer. Over the last three years, SDIO has made significant progress in reducing the total weight to orbit for the Phase I mission model. As a result, it is apparent that an ALS-type vehicle is not required for deployment of SDIO Phase I. Current launch vehicles, with additional facility investment, can launch Phase I architectures. ALS is required, however, for follow-on SDIO phases, but the schedule for the development of these payloads in less certain. At the same time, NASA has identified a heavy lift requirement for the Lunar/Mars initiative, but the schedule for this initiative is also undercertain. All these factors, combined with a FY 1990 budget lower than requested, have forced a restructuring of the ALS program.

The restructure program is now known as the Advanced Launch Development Program. Because the ALS vehicle studies identified low cost, highly reliable engines as a key enabling technology for a new family of launch vehicles, the restructured program emphasizes accomplishment of previously identified propulsion work.

Design work on specific vehicle concepts was terminated at the System Design Review in January 1990. At currently projected funding levels, only propulsion work will continue in FY 1991.

In FY 1991, SDIO will provide $25 million, the Air Force-$60 million, and NASA-$40 million, for a total programs of $125 million.

Question. What are the goals of the restructured program?

Answer. The restructured program continues to be driven by the same goals as the original ALS program, that is, reliable, low cost, operable space transportation. The Advanced Launch Development Program continues to be a joint DoD/NASA project, with a joint project office that taps the best of DoD and NASA launch expertise. Because of funding reductions by both SDIO and the Air Force, the broad scope of the program has been curtailed. The current program concentrates on development of a high thrust, low cost, reliable liquid engine that can form the basis for a new family of launch vehicles. Engine component technologies will be demonstrated in FY91 and prototype engine development will begin FY

92. This approach will protect an option to restart a vehicle development in the mid 1990s.

Question. When would we actually field an advanced launch system under your new plan?

Answer. Since there are no Full Scale Development (FSD) funds in the ALS program, there is no firm IOC. Without near term FDS funding, the IOC will be 2000 or beyond.

Question. The fiscal year 1991 budget request $60 million for ALS, of which $25 million is in SDI. How would these funds be used?

Answer. The current funding for ALS is $60 million from the Air Force and $25 million from SDIO. NASA will also contibute $40 million, for a total program of $125 million. These funds will be used for propulsion technology and development. Previous ALS studies have shown that a low cost engine is the key to low cost space transportation. Propulsion development is also the pacing item in the development of a new vehicle. Specifically, the funding will allow demonstration of low cost engine component technologies that, in turn, will permit prototype engine development to begin in FY 1992.

Question. Given your apparent disinterest in pursuing a robust program, why should Congress provide any funds at all?

Answer. Both the Air Force and SDIO are still committed to the ALS program. The restructured program is simply a result of reduced DoD budgets. The existing fleet of launch vehicles, with the exception of the Shuttle, are approaching 40 years old. They are increasingly expensive and difficult to maintain. The nation must plan orderly replacement of these vehicles if we are to continue to be a truly spacefaring nation. ALS offers an opportunity to "normalize" space launch operations while at the same time increasing reliability and reducing cost. For all these reasons, Congress should continue to fund ALS.

Question. Last year you testified that OSD had tasked the Air Force to identify the most cost effective space launch architecture for deploying the Phase I SDI system as well as other national needs, and that the results of the study would be available in the fourth quarter of last fiscal year. Was the study completed, and what were the results? Please place into the record at this point an executive summary of the study.

Answer. The study was essentially complete in September 1989, and the published, final report was delivered to SDIO in December 1989. While the original objective of the study was to determine the singular, most cost-effective launch architecture, as the study progressed, it became apparent that there were too many variables unresolved in both the final mission model for Phase I SDS, and for the other national needs. The thrust of the analysis changed to determine a range of launch solutions for various permutations of the approved Phase I SDS architecture, each of which was costed. The bottom line of the study concluded that the nation has a number of cost-effective launch options available to satisfy both the requirements of the Phase I SDS and of other national needs. The addition of Phase I SDS onto existing launch requirements will demand the construction or modification of launch facilities to increase the national throughput. The nation today simply does not have much excess launch facility capacity lying unused. The current family of launch vehicles can handle the launch all our national payloads. While the current vehicles can handle the launch of Phase I SDS, those vehicles reflect 40 year old technology, and the ability to launch Phase I SDS should not be interpreted as a lack of need for follow-on launch vehicles. The executive summary of the study was provided for the Committee's files.

SPACE SURVEILLANCE AND TRACKING SYSTEM

Question. This fiscal year 1991 budget includes $95 million to further define the Space Surveillance and Tracking System (SSTS). General Monahan, your statement indicates the role of SSTS in the Phase I architecture is being reassessed. Why?

Answer. The role of SSTS in the Phase I architecture is being reassessed because of fundamental changes in the Phase I design stemming from the Space Based Architecture Study last summer. With the adoption of Brilliant Pebbles (BPs), as the boost and post-boost weapon system, weapon target assignments and in-flight targeting up-dates are not necessary as they were for the Space Based Interceptor (SBI) program. These were functions that SSTS performed previously. Also, BP does not currently intercept midcourse objects, thus midcourse object tracking is not needed as early as before. In addition, the Early Attack Characterization (EAC) GSTS probes have been added to the architecture to provide initial track information on clusters of midcourse objects. The results of our review of the midcourse sensor and weapons issues will be conveyed to Congress upon completion.

Question. What purpose would SSTS serve if it were not to be used for Phase I? Provide for the record a complete list of all missions SSTS could satisfy.

Answer. SSTS still has very definite and necessary roles in the Phase I architecture. These missions are in four distinct areas: BMD, Space Surveillance, Integrated Tactical Warning/Attack Assessment (ITW/AA), and Data Collection.

For BMD, the SSTS provides continuation of BSTS tracks on PBVs and deployed objects for handover to the GSTS. This allows timely battle planning and relaxes timelines for critical decisions by CINCSPACE and optimizes the limited GSTS resources. ———. The SSTS provides enhanced accuracy of midcourse cluster or objects when fused with GSTS data. Finally, the SSTS provides acquisition and tracking of Soviet ASATs detected by SDS and other national space assets.

For Space Surveillance, the SSTS meets all of the space surveillance mission requirements in the AFSPACECOM Space Surveillance Statement of Operational Need (SSSON 89-002). These missions include: Satellite attack warning, overflight warning, space catalog maintenance, US ASAT engagement support, treaty monitoring, and scientific and technical intelligence.

For ITW/AA the SSTS improves on track data provided by BSTS by tracking clusters and single objects deployed from PBVs. SSTS provides the earliest capability to predict impact points necessary for preferential defense. ———. The collection of test data of multiple wavelengths provides the information to optimize weapon and sensor systems and provides the target signatures necessary to validate discrimination algorithms.

Question. Justification material indicates "ASAT acquisition and tracking is a mission SSTS is uniquely capable of performing." Is this why funding is being pursued in fiscal year 1991?

Answer. Funding is being pursued in fiscal year 1991 because SSTS is a necessary element of the SDS. As detailed previously, SSTS has both wartime and peacetime missions. These missions are necessary to develop the Phase I SDS and follow-on phases. ASAT acquisition and tracking is just one of numerous missions detailed in the above response.

Question. The recent Defense Science Board report states "SSTS is not needed for boost/post-boost intercepts. SBI (Space-Based Interceptor) contractors seem to agree. This architectural change implies that the SSTS should be rethought based on its other purposes. A rethought SSTS may be less complex and less costly than the current version." What is SDIO doing to "rethink" the SSTS concept? Why spend money on something whose concept is not well defined?

Answer. SDIO is in the process of rethinking the SSTS concept. Beginning in the end of May is the Midcourse and Terminal Tier Review Study which will be involving SDIO, the services, the POET, the national labs, and contractors. This study will revisit all of the midcourse sensors and weapons to rethink all issues and make appropriate recommendations. The SSTS concept is fairly well defined. The system design had reached its first design milestone last year before the SBAS. Also, several technology demonstrations have been initiated and some completed to demonstrate the necessary technology for SSTS. The current emphasis is on the SSTS Validation Satellites (SVS) which are near term technology satellites to provide demonstration of the SSTS concept through initial data collection and space surveillance operations, technology demonstrations, and functional demonstrations for the SSTS program.

Question. How will the fiscal year 1991 funds for SSTS be used?

Answer. Fiscal year 1991 funds are divided among four prime areas, these are: the Space Based Visible (SBV) Sensor, the Prototype Flight Cooler (PFC), the SSTS Validation Satellite (SVS), and the SSTS system design.

The SBV is a visible sensor payload on the Midcourse Space Experiment (MSX). SBV has just completed its critical design review and is in fabrication. During FY 1991, the fabrication will be nearly complete with much of the integration and testing complete. The SBV will be delivered to Johns Hopkins University Applied Physics Laboratory in FY 1992 for integration on MSX with launch in FY 1993.

The PRC is a technology development program to develop a long life, light weight, low power, high reliability cryogenic refrigeration necessary for the SSTS program. This development is in the engineering evaluation phase for many subelements of the complete design. In FY 1991, fabrication will be completed on the test unit and long life testing will be initiated.

The SVS is the primary emphasis the SSTS program. The System Design Review will be complete in 4QFY90 and the preliminary design begun. In FY 1991, the SVS design will continue with preliminary design ready complete and the detail design started.

The SSTS system design has been reduced in scope to allow for the development of the validation satellite. System studies will continue at a low level.

AIRBORNE OPTICAL ADJUNCT (AOA)

Question. SDI has invested about $.5 billion in an airborne sensor system called Airborne Optical Adjunct which is intended to distinguish the infrared signatures of real ICBMs from decoys, and to hand off information to ground based radars.

General Monahan, the illustration in your statement does not even show AOS. Is this because it is stealthy?

Answer. The AOA does not incorporate any stealth technology. The AOA is not an element of the Phase I Strategic Defense System (SDS), and for that reason is not shown in the illustration in my statement.

Question. Is AOA required in the SDI Phase I system?

Answer. AOA is an experimental testbed which will be used in the development of the Phase I optical sensors. AOA, as an element proper, is not part of the Phase I SDS. The AOA, in its combat role, was originally intended to provide cueing data to ground radars for terminal defense using the HEDI interceptor. The Phase I SDS, as approved in 1988, did not include the terminal defensive layer with HEDI nor a ground-based radar. As a result, the AOA was not included as an element in the Phase I SDA, but was retained as an optical sensor testbed.

Question. In what SDI phase would it be needed?

Answer. AOA is an experimental testbed and not currently envisioned to be in any phase of the SDS. However, to date, only Phase I SDS is clearly defined. The concept of optical surveillance sensors on airborne platforms has been considered in past architecture concepts and certainly is a candidate in ongoing studies to define the follow-on SDS. AOA's similarily to such concept makes it an ideal, functioning platform to demonstrate the usefulness of an airborne optical sensor in new concepts.

Question. What plans do you have to drop AOA from the SDI program?

Answer. SDIO has no plans to drop the AOA from the SDI program. The AOA was one of the very first sensors for SDI to build with a first flight on 11 May 1990. In September 1990, the SDI will begin to harvest the fruits of our investments in AOA. While the AOA is not a part of the Phase I SDS, the usefulness of the AOA as an Airborne Surveillance Testbed (AST) is immense. And to reflect the change of mission, AOA has been called the AOA/AST since the approval of Phase I in 1988. The AST will address two basic issues which must be resolved for a highly successful SDS. First, our basic understanding of how optical sensors in a realistic environment must be improved. The AST, observing the many test shots into USAKA, will gather a great deal of critical data. Second, the AST will provide real time optical sensor data which can support other element development. Examples might include the generation of a threat object map for an ERIS test, or the fusion of radar and optical data in the development of the command center element.

Question. What plans do any of the other Services have for picking up AOA as a non-SDI program, and if any, for what purpose?

Answer. SDIO has no plans to drop the AOA from the SDI program, and there are no known plans for any Service to pick up AOA. If, however, and Service finds AOA potentially useful in some test program, SDIO would certainly make every effort to provide AOA support to them.

Question. How much is budgeted in fiscal year 1991 for AOA?

Answer. The current budget within the SDIO fiscal planning documents reflects $40.3 million. However, based upon a review of the program on 9 February 1990. I have agreed to increase the amount by $23.8 million to a total $64.1 million. Of course, as the final FY 1991 budget is assembled, that amount could change as other program priorities are considered as well.

DIRECTED ENERGY WEAPONS

Question. SDIO does research on longer term programs aimed at fielding advanced technologies in the future, namely directed energy weapons. General Monahan, would you please take a moment and describe to the Committee the status of SDI's directed energy programs.

Answer. Our directed energy programs emphasize the space-based neutral particle beam, the ground-based free electron laser and the space based chemical laser weapon concepts. A common ATP–FC program supports all of these.

The neutral particle beam has made significant progress in decreasing the size and weight of accelerator components (RF quadrupole and drift tubes), and in scaling up the performance of the beam generation (ion source, foil neutralizer) and control (magnetic telescope, wire shadow sensor) subsystems. A space test, Beam Experiment Aboard Rocket (BEAR), has been completed which shows no "show stoppers" for generation and propagation of the beam. Assembly of the ground demonstrator (GTA) has begun; and the Pegasus space experiments, in which all beam generation and control functions will be demonstrated, is now being designed.

A ground-based RF (radio frequency) free electron laser has been operated at visible wavelength, and an optical resonator using unique grazing incidence optics has been demonstrated. The infrastructure for a research facility at the White Sands Missile Range is progressing. The RF free-electron laser has been selected for further development, and negotiations for building a high average power laser are pending. Theoretical work on beam propagation through heated, turbulent air has been carried out to determine promising approaches for achieving efficient propagation from ground to space. An experiment evaluating such approaches, Scaled Atmospheric Blooming Laser Experiment (SABLE), is underway.

High-power operation of Alpha, the space-based chemical laser demonstrator, has been achieved. A large diameter pointing mirror (LAMP) has been built using lightweight technology appropriate for space use. Robust multilayer highly reflective coatings have been developed and tested to fluences well above those expected in a weapon level system. A subscale beam control system for maintaining a stable, intense spot on the target has been successfully demonstrated in low-power laboratory tests (LODE). Other progress includes study and scaleup of short wavelength chemical laser technology (overtone operation), development of a system for smoothly and rapidly scanning a high-power beam from one target to another, and experiments confirming the possibility of applying phase conjugation to high-power chemical laser beam control. A concept, and requirements for, space experiments with the Alpha laser and LAMP mirror (Zenith Star) are complete. High-power ground integration of the LAMP mirror with the Alpha laser has begun, and a moderate power experiment (Complementary Space Experiment, CSE) is being developed to resolve space operation issues.

Each of these weapon concepts is supported by a vigorous Acquisition, Tracking, Pointing and Fire Control (ATP–FC) research program. The focus of our ATP–FC research is Starlab, a shuttle-based experiment whose primary objective is to validate our capability to acquire, track and very accurately maintain an aimpoint on thrusting booster rockets. Integration of the Starlab system has begun. Starlab ILC is early 1992. The Low-power Atmospheric Compensation Experiments (LACE) and Relay Mirror Experiment (RME) satellites have been launched as part of a series of key experiments supporting the ground-based laser concept. The satellites and their associated ground facilities are undergoing checkout tests. LACE sensors will measure laser beams transmitted from the AMOS (Air Force Maui Optical Station) to determine our ability to correct a laser beam for atmospheric distortions. RME will validate our capability to relay precisely a laser beam from Earth to the RME satellite and back to Earth. Other research progress includes development and exercise of the Rapid Retargeting-Precision Pointing (R2P2) laboratory, a simulator for studying the response of large structures to the slewing motions required to repoint large space platforms, and the development and validation of magnetic vibration isolators to aid in stably pointing the very large beam expander telescopes required for laser weapons.

Finally, SDIO supports efforts in Nuclear-Driven Directed Energy Weapons (NDEW) which complement the DoE's larger investments in these technologies. SDIO supports above ground experiments, development of instruments to diagnose output produced by such technologies, and concept studies. The objective is to understand the potentials of these technologies well enough to make a timely determination of their military utility including assessing the threat posed by possible use by an adversary.

Summary. The Neutral Particle Beam (NPB) program has developed scalable subsystem components, demonstrated operation in space, is constructing a high-power beam generator (GTA) and is beginning both ground and space integration demonstrations. The Space-based Chemical Laser (SBCL) program has developed scalable subsystem components, a high average power beam generator (ALPHA) and is also beginning both ground and space integration demonstrations. The Free Electron Laser (FEL) has accomplished significant proof-of-principle demonstrations, and is beginning engineering scale-up of the device. Resolution of the transmission of a high-power laser beam through the atmosphere is still an issue which is being investigated. Construction of a research facility is underway at the White Sands Missile Range (WSMR). Delivery of the majority of Starlab hardware is complete, and integration has begun. Experiments with the LACE and RME satellites are underway.

Question. What progress has been made during the last year?

Answer. For the NPB: Demonstrated a weapon-scale magnetic telescope; fabricated and tested near-full scale neutralizer foils. Began concept development for the Power System Demonstrator. Began assembly of the Ground Test Accelerator. Demonstrated operation of a neutral particle beam generator in space (BEAR). Conducted beam funnel proof-of-principle experiment and demonstrated weapons-scalable beam direction sensing technology.

For the FEL. Selected RF FEL for scaling to high average power; completed laboratory demonstration of technique for measurement and control of large, lightweight flat mirrors for relay of beam from ground to mission mirror; completed preliminary study of production techniques, and potential enhancements, for large mirrors; completed checkout of the SABLE experiment.

For the SBCL. Continued testing of the Alpha high-power chemical laser; completed laboratory demonstration of a technique for remote alignment of complex optical systems; completed fabrication and testing of a wide-field-of-view telescope for demonstrating rapid optical retargeting; completed engineering scaleup of method for applying beam sampling gratings to very large primary mirrors; completed requirements development for the Zenith Star experiments.

For ATP–FC. Starlab hardware near completion; integration initiated. LACE and RME satellites launched, checkout procedures underway; experiment planning and acquisition of instrumented target rockets (Starbirds) continues. Installation of technology testbeds for vibration isolation begun. Fire control prototype testbed operational.

For NDEW. Successfully conducted testing of a directed nuclear energy laser system concept.

Question. What events are planned for fiscal year 1991?

Answer. For the NPB: Initial operation of the Ground Test Accelerator (at 24 MeV); preliminary design review of the Pegasus space integration experiment; completion of Continuous Wave Deuterium Demonstrator (CWDD) fabrication.

For the FEL. Begin design for scaling up RF FEL technology to high average power; complete infrastructure at White Sands research facility; complete SABLE experiments; continue development of technologies to enable efficient and precise transmission of high-power beams from ground to space relay mirror, and from relay mirror to mission mirror.

For the SBCL. Complete Alpha high-power characterization tests; complete design and long-lead hardware procurements for the Alpha-LAMP high-power ground integration experiments; complete design for the mid-power space integration experiments (CSE); complete demonstration of high-power short wavelength chemical laser; complete static tests of rapid optical retargeting technique; begin fabrication of full-size lightweight mirror facesheet.

For ATP–FC. Complete integration of Starlab hardware into Spacelab module, continue LACE and complete RME experiments. Conduct first test of Starbird booster targets.

For NDEW. Continue above ground experiments and diagnostic development.

Question. How much is requested in fiscal year 1991 for directed energy and other advanced concepts, and how will these funds be used?

Answer. (For Directed Energy only) The FY 1991 request is for $802.9 million, apportioned as follows:

	Million
FEL	$130.0
CL	211.0
NPB	165.0
ATP/FC	225.0
NDEW	15.0
IS&T	14.4
DEW Systems	12.0
Operational Support	28.2
Sandia Lab	2.3
Total	802.9

For NPB. The funds will be used primarily to continue construction of the Ground Test Accelerator. Other significant activities include maturation of the Pegasus space experiment concept and fabrication of the Continuous Wave Deuterium Demonstrator (CWDD), which is resolving problems associated with continuous operation of high-power particle beam generators, and initial operation of the power system demonstrator.

For FEL. The funds will be used primarily to begin scaleup of the technology to high average power. Other activities include: completion of the infrastructure for the WSMR research facility; studies and subscale component development for space basing; coating and beam control component development; and continued development of robust methods of compensating for distortions induced by heated and turbulent air.

For SBCL. The principal activities are design and fabrication of high-power ground and moderate-power space integration experiments. Also, the Alpha high-power laser will be characterized; engineering scaleup of methods for fabricating very large mirrors will continue; initial experiments demonstrating rapid optical retargeting will take place; and a high-power demonstration of a short-wavelength chemical laser will occur.

For ATP–FC. The principal activity involves completion of the integration of the Starlab hardware. LACE/RME experiments, fire control, retargeting, pointing and advanced tracking technology developments will continue.

For NDEW. Funds will be used to determine the feasibility of a directed nuclear energy laser system, conduct above ground experiments, and develop beam diagnostic instruments.

[CLERK'S NOTE.—End of questions submitted for the record.]

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